Vol. 10, No. 22
November 30, 1985

# Energy Research Abstracts

Abstracts 45932-48001

Office of Scientific & Technical Information
UNITED STATES DEPARTMENT OF ENERGY

# CURRENT AWARENESS PUBLICATIONS ON ENERGY

To provide complete coverage of literature related to major Department programs, announcement publications that are comprehensive in their coverage of certain energy fields are issued regularly. All information in these publications, plus additional backup information, is included in the Energy Data Base of the Office of Scientific and Technical Information; all references are also available for machine searching via the on-line retrieval system, DOE/RECON, and the commercial on-line retrieval systems. Descriptions of these current awareness publications, which are supported either directly or indirectly by the DOE, appear below. Department of Energy components may receive the listed publications free from the Office of Scientific and Technical Information, U. S. Department of Energy, P. O. Box 62, Oak Ridge, TN 37831. Telephone (615) 576-1301; FTS 626-1301.

## PUBLICATIONS OF THE OFFICE OF SCIENTIFIC AND TECHNICAL INFORMATION

***Energy Abstracts for Policy Analysis (EAPA)***

A monthly abstract journal devoted to the analysis of energy research, conservation, and policy. Scope and coverage are limited to substantive articles or reports and emphasize legislative, regulatory, and other legal aspects, as well as social, economic, and environmental impacts. *EAPA* is available from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. The annual subscription price is $72.00 for domestic (North America) or $90.00 for foreign (outside North America) subscribers; a single issue is $5.00 or $6.25, respectively.

***Energy Research Abstracts (ERA)***

A comprehensive semimonthly abstract journal devoted to all areas of energy-related information produced by the Department of Energy, other U. S. government organizations, and foreign governments. *ERA* is available from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. The annual subscription price for the 24 issues is $146.00 for domestic (North America) subscribers or $182.50 for foreign (outside North America) subscribers. A single issue is $14.00 or $17.50, respectively.

***DOE Patents Available for Licensing (PAL)***

DOE is prepared to grant exclusive or nonexclusive, revocable licenses under DOE-owned U. S. patents and patent applications; this semiannual publication provides abstracting and indexing coverage of this literature. *PAL* is available on subscription (use PB85-946800) from the National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161. The annual subscription price is $14.00 for domestic (North America) or $28.00 for foreign (outside North America); a single issue is $8.00 or $16.00, respectively.

***Energy Meetings (EM)***

A monthly listing of conferences, symposia, workshops, etc., pertaining to DOE's programmatic interests. *EM* is available on subscription (use PB85-901500) from the National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161. The annual subscription price is $40.00 for domestic subscribers and $80.00 for subscribers outside the North American continent; a single issue is $5.00 and $10.00, respectively.

The following monthly update journals are available to the public on subscription from the National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161; use the identifying order number (PB- No.) when subscribing. The annual subscription price (12 issues plus cumulative index) is $75.00 for domestic (North America) and $150.00 for foreign (outside North America) subscribers; a single issue is $7.00 and $14.00, respectively.

***Current Energy Patents (CEP)*–PB85-902800**

Devoted to international patent literature, including patent applications, on any aspect of energy production, conservation, and utilization.

***Energy and the Environment (EAE)*–PB85-914900**

Devoted to information on the impacts of energy-related activities and radioactive and nonradioactive pollutants on the environment.

***Fossil Energy Update (FEU)*–PB85-914600**

Devoted to information on the exploration, development, processing, and use of fossil fuels.

***Fusion Energy Update (CFU)*–PB85-915300**

Devoted to information on controlled thermonuclear fusion, including plasma and fuel research and power plant engineering and conceptual design studies.

***Solar Energy Update (SEU)*–PB85-914500**

Devoted to information on the utilization of solar energy, including biomass and tidal and wind power.

The following semimonthly bulletins are also available from the National Technical Information Service. The annual subscription rate for one volume (calendar) year (24 issues; no indexes) is $40.00 for domestic (North America) and $80.00 for foreign (outside North America) subscribers; use the identifying order number (PB- No.) when subscribing.

***Acid Precipitation (APC)*–PB85-901000**

Covers all aspects of acid precipitation, including effects and possible control measures.

***Buildings Energy Conservation (BEC)*–PB85-900700**

Covers worldwide information on the technology required for energy conservation in buildings of all types.

***Coal-Based Synfuels (CBS)*–PB85-901400**

Covers all aspects of conversion of coal into gaseous or liquid fuels.

***Coal Preparation and Pollution Control (CPC)*–PB85-900800**

Covers all aspects of coal preparation and cleaning and reducing pollution from its direct combustion.

***Direct Energy Conversion (DEC)*–PB85-946600**

Covers the following areas: photovoltaics, magnetohydrodynamics, electrohydrodynamics, thermoelectrics, thermionics, and fuel cells.

***Energy from Biomass (EFB)*–PB85-900600**

Covers worldwide information on all aspects of biomass production, conversion, and utilization for energy.

***Geothermal Energy Technology (GET)*–PB85-914700**

Covers information on the exploration, development, and utilization of geothermal resources.

***Heavy-Ion Reactions (HIR)*– PB85-900500**

Covers all aspects of heavy-ion (A > 4) reactions.

***Laser Research (LAR)*–PB85-901100**

Covers all aspects of laser research and development, but excludes applications.

***Nuclear Fuel Cycle (NFC)*–PB85-913400**

Covers all aspects of the nuclear fuel cycle, both front end and back end.

***Nuclear Reactor Safety (NRS)*–PB85-913500**

Covers the safety aspects of accident analysis, safety systems, radiation protection, decommissioning and dismantling, and security measures.

***Radioactive Waste Management (RWM)*–PB85-902900**

Covers the management aspects of transport and storage, waste processing, waste disposal, waste storage, radioactive effluents, and shipping containers.

***Solar Thermal Energy Technology (STT)*–PB85-901200**

Covers research in materials, concentrators/receivers, salinity gradients, etc., for development of efficient and reliable solar thermal conversion systems.

***Unconventional Petroleum (UCP)*–PB85-901300**

Covers all aspects of secondary and tertiary recovery of petroleum and of oil shales and tar sands.

## INTERNATIONAL ENERGY PUBLICATIONS

The Office of Scientific and Technical Information (OSTI) cooperates in the publication of international abstract journals with the following: (1) International Atomic Energy Agency, International Nuclear Information System, Vienna, Austria, for *Atomindex;* (2) International Energy Agency, Biomass Conversion Technical Information Service, Dublin, Ireland, for *Biomass Abstracts;* and (3) International Energy Agency, IEA Coal Research, London, England, for *Coal Abstracts.* In each case, the cognizant foreign agency provides the non-U. S. information to OSTI for inclusion in the Energy Data Base; in turn, OSTI provides the U. S. information for input into the respective journal.

***Atomindex***

A semimonthly abstract journal providing worldwide coverage of information on nuclear science and technology. *Atomindex* is available by subscription from UNIPUB, 345 Park Avenue South, New York, NY 10010. The cost of an annual subscription, 24 semimonthly issues and semiannual and annual cumulative indexes, is $290.

***Biomass Abstracts***

A bimonthly abstract journal with comprehensive coverage of information in any step involved in the eventual conversion of biomass to energy. *Biomass Abstracts* is available free to Department of Energy components and contractors from OSTI. Non-DOE organizations may obtain *Biomass Abstracts* from Biomass Conversion Technical Information Service, Institute for Industrial Research and Standards, Ballymun Road, Dublin 9, Ireland, for 42 IR pounds per year. Make checks payable to the Institute.

***Coal Abstracts***

A monthly abstract journal providing comprehensive worldwide coverage of information in the field of coal science and technology. *Coal Abstracts* is available to Department of Energy components and contractors from OSTI. Non-DOE organizations may obtain *Coal Abstracts* from IEA Coal Research, Technical Information Service, 14-15 Lower Grosvenor Place, London SW1W 0EX, England, for 100 pounds sterling per year.

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# ENERGY RESEARCH ABSTRACTS

**ABOUT THE OFFICE OF SCIENTIFIC AND TECHNICAL INFORMATION**

The Office of Scientific and Technical Information (OSTI) in Oak Ridge, Tennessee, has been the national center for scientific and technical information for the Department of Energy (DOE) and its predecessor agencies since 1946. In developing and managing DOE's technical information program, OSTI places under bibliographic control not only DOE-originated information but also worldwide literature on scientific and technical advances in the energy field and announces the source and availability of this information. Whereas the literature of science is emphasized, coverage is extended to DOE programmatic, socioeconomic, environmental, legislative/regulatory, energy analysis, and policy-related areas. To accomplish this mission, OSTI builds and maintains computerized energy-information data bases and disseminates this information via computerized retrieval systems and announcement publications such as abstracting journals, bibliographies, and update journals. Direct access to OSTI's most comprehensive data base, the Energy Data Base, is available to the public through commercial on-line bibliographic retrieval systems. The Energy Data Base and many of OSTI's energy-related data bases are available to DOE offices and contractors and to other government agencies via DOE/RECON, the Department's on-line information retrieval system. The Office of Scientific and Technical Information has developed and maintains systems to record and communicate energy-related research-in-progress information, to maintain a register of DOE public communications publications, to track research report deliverables from DOE contractors, and to test and make available DOE-funded computer software programs with scientific and management applications; OSTI also serves as adviser for special publication needs of the Department. To effectively manage DOE's technical information resources, OSTI's program is one of continual development and evaluation of new information products, systems, and technologies.

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## ABOUT *ENERGY RESEARCH ABSTRACTS*

*Energy Research Abstracts (ERA)* provides abstracting and indexing coverage of all scientific and technical reports, journal articles, conference papers and proceedings, books, patents, theses, and monographs originated by the U. S. Department of Energy, its laboratories, energy centers and contractors. *ERA* also covers other energy information prepared *in report form* by federal and state government organizations, foreign governments, and domestic and foreign universities and research organizations. The user should remain aware that *ERA* coverage of non-report literature is limited to that generated by Department of Energy activity.

*ERA* is comprehensive in its subject scope, encompassing the DOE's research, development, demonstration, and technological programs resulting from its broad charter for energy sources, supplies, safety, environmental impacts, and regulation.

*ERA* is available on an exchange basis to universities, research institutions, industrial firms, and publishers of scientific information. Inquiries should be directed to the Office of Scientific and Technical Information, P. O. Box 62, Oak Ridge, TN 37831.

*ERA* is available to the public on a subscription basis from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. The subscription rate for the 24 semimonthly issues is $146.00 for domestic subscribers and $182.50 for foreign subscribers. A single issue costs $14.00 (domestic) or $17.50 (foreign). The cumulative indexes will be available in printed form from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402. The GPO Stock Number is 061-000-00657-5 and the price is $83.00 for the Vol. 9 indexes. The cumulative indexes are also available in microfiche form from the National Technical Information Service, U. S. Department of Commerce, Springfield, VA 22161, and from Engineered Systems, P. O. Box 866, Oak Ridge, TN 37831.

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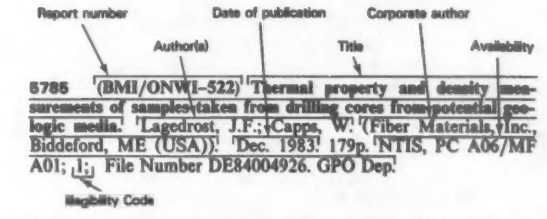
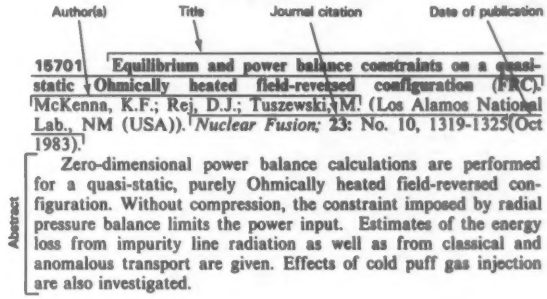
**United States Department of Energy, P. O. Box 62, Oak Ridge, TN 37831**

## ABSTRACTS IN *ENERGY RESEARCH ABSTRACTS*

The principal elements of abstract entries for a typical research and development report and a typical technical journal article are illustrated below.


Report number
Date of publication
Corporate author
Author(s)
Title
Availability
5785 (BMI/ONWI-522) Thermal property and density measurements of samples taken from drilling cores from potential geologic media. Lagedrost, J.F.; Capps, W. (Fiber Materials, Inc., Biddeford, ME (USA)). Dec. 1983. 179p. NTIS, PC A06/MF A01; 1; File Number DE84004926. GPO Dep.
Legibility Code
Abstract
Density, steady-state conductivity, enthalpy, specific heat, heat capacity, thermal diffusivity and linear thermal expansion were measured on 59 materials from core drill samples of several geologic media, including rock salt, basalt, and other associated rocks from 7 potential sites for nuclear waste isolation. The measurements were conducted from or near to room temperature up to 500°C, or to lower temperatures if limited by specimen cracking or fracturing. Ample documentation establishes the reliability of the property measurement methods and the accuracy of the results.


Author(s)
Title
Journal citation
Date of publication
15701 Equilibrium and power balance constraints on a quasi-static, Ohmically heated field-reversed configuration (FRC). McKenna, K.F.; Rej, D.J.; Tuszewski, M. (Los Alamos National Lab., NM (USA)). Nuclear Fusion; 23: No. 10, 1319-1325 (Oct 1983).
Abstract
Zero-dimensional power balance calculations are performed for a quasi-static, purely Ohmically heated field-reversed configuration. Without compression, the constraint imposed by radial pressure balance limits the power input. Estimates of the energy loss from impurity line radiation as well as from classical and anomalous transport are given. Effects of cold puff gas injection are also investigated.

## INDEXES TO *ENERGY RESEARCH ABSTRACTS*

Five indexes are provided for approaching the contents of each issue of *Energy Research Abstracts (ERA)*. Each index is preceded by an introduction that details the organization of the index and the principles by which it was compiled. The reader is referred to these introductions for information not found in the index examples that follow.

### • Corporate Author Index

Technical report literature is indexed using the name of the organization or institution responsible for the issuance of the report.

5785 (BMI/ONWI-522) **Thermal property and density measurements of samples taken from drilling cores from potential geologic media.** Lagedrost, J.F.; Capps, W. **(Fiber Materials, Inc., Biddeford, ME (USA)).** Dec. 1983. 179p. NTIS File Number DE84004926. GPO Dep.

is indexed as:

**Fiber Materials, Inc., Biddeford, ME (USA)**

### • Personal Author Index

Each author's name is indexed in the form appearing on the document abstracted, with the exception that given names are reduced to initials:

**Capps, W.,** *See* Lagedrost, J. F.
**Lagedrost, J.F.,** Thermal property and density measurements of samples taken from drilling cores from potential geologic media, 9:5785 (R;US)
**McKenna, K.F.,** Equilibrium and power balance constraints on a quasi-static Ohmically heated field-reversed configuration (FRC), 9:15701 (J;US)
**Rej, D.J.,** *See* McKenna, K.F.
**Tuszewski, M.,** *See* McKenna, K.F.

### • Subject Index

The subject index consisting of entries naming specific materials, objects, and processes is arranged alphabetically. Document titles, informative phrases, or both specific to these entries are arranged alphabetically under the entries.

**SALT DEPOSITS**
**Density**
Thermal property and density measurements of samples taken from drilling cores from potential geologic media, 9:5785 (R;US)
**REVERSED-FIELD PINCH**
**Energy Balance**
Equilibrium and power balance constraints on a quasi-static Ohmically heated field-reversed configuration (FRC), 9:15701 (J;AT)

### • Contract Number Index

DOE technical report literature is indexed using contract numbers. This index contains the contract number with corresponding abstract and report numbers.

**AC06-76RL01830** **Fiber Materials, Inc., Biddeford, ME (USA)** 9:5785 BMI/ONWI-522

### • Report Number Index

Technical report literature is also indexed using report numbers. This index includes information on where individual reports may be obtained. Patents and conference papers are indexed here as a matter of convenience. When a report is supplied under a File Number, that number is included in the availability statement. A file number–report number correlation is included for convenience.

**BMI/ONWI-522** 9:5785 NTIS, PC A09/MF A01. File Number DE84004926, Distribution Category MN-70

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CEA Centre d'Etudes de Saclay
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Fachinformationszentrum
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IEA Biomass Conversion Service
Dublin, Ireland

IEA Coal Research
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International Atomic Energy Agency
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Graduate School of Library and Information Sciences
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Communication concerning the editorial policy and content of *Energy Research Abstracts* should be addressed to the Editor, *Energy Research Abstracts,* Office of Scientific and Technical Information, P. O. Box 62, Oak Ridge, TN 37831.

# SUBJECT CONTENTS (NUMERICAL LISTING)

Six-digit subject category numbers are used in the storage, retrieval, and manipulation of bibliographic information entered into DOE's computerized bibliographic information system. The six-digit category numbers are utilized as if they were three pairs of two-digit numbers, the first two pairs being used to arrange the abstract content of *Energy Research Abstracts*. The following listing includes the totality of the 39 first-level and 293 second-level subject categories used. Because each issue of *ERA* announces only those documents becoming available during a semi-monthly period, some subject categories may not be represented in every issue. The complete subject category scheme with scope definitions and limitations is available as DOE/TIC-4584-R6 from NTIS for $9.50.


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# ENERGY RESEARCH ABSTRACTS

## 01 COAL AND COAL PRODUCTS

*REFER ALSO TO CITATION(S) 46619, 46620*

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45932 **(ANL/FE—85-5) Corrosion behavior of coated 2 1/4 Cr-1Mo and mild steel substrates in a simulated waste heat recovery system environment of a coal gasifier.** Baxter, D.J. (Argonne National Lab., IL (USA)). Jul 1985. Contract W-31-109-ENG-38. 40p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85017665.

Cossosion tests have been conducted on coated 2 1/4Cr-1Mo and A106 mild steel in a gaseous environment typical of that expected in a downstream waste-heat recovery system of a coal gasifier. The environment contained controlled oxygen and sulfur levels, and the tests were run in a rig designed to expose specimens under simulated heat-exchanger conditions. Uncoated steel substrates exhibited breakaway corrosion behavior. Furnace-fused coatings of FeCrAl or CoCrAl alloys contained numerous defects, such as voids and cracks, and subsequently underwent substantial degradation during exposure. Coatings containing the stable oxide-forming elements Al and Cr were also applied by pack diffusion processes. Sequential chromizing of the A106 mild steel could not be achieved due to massive Cr carbide formation in the initial chromizing stage. Sequential chromizing/aluminizing of the 2 1/4Cr-1Mo steel was successful, but the coating contained numerous defects, which permitted considerable attack of the coated substrate. Simultaneous aluminizing/chromizing produced mixed results, depending upon the particular process used in applying the coating. Coatings exhibited behavior ranging from protective to complete breakdown. A solid FeCrAlY alloy exhibited protective oxidation behavior. With respect to joining or repair methods for coated steels, four different weld metals were used to simulate joining or repair operations of prior aluminized steel substrates. The Ni-base Inconel 625 weld showed good corrosion resistance with Inconel 72 sustaining minor internal attack. The Co-base L605 and Fe-base 309 SS weld metals exhibited breakaway corrosion characterized by the formation of thick scales and deep internal attack. 19 refs., 21 figs., 3 tabs.

45933 **(DOE/ET/10069—T116) EDS coal liquefaction process development: Phase V. EDS Bottoms Gasification Verification Program.** (Exxon Research and Engineering Co., Annandale, NJ (USA)). Jul 1985. Contract FC05-77ET10069. 276p. (FE—2893-156). NTIS (US Sales Only), PC A13/MF A01; 1; GPO Dep. File Number DE85017113.

This report documents the nonconfidential results of the EDS Bottoms Gasification Verification program. The primary goal was to confirm the applicability of the Texaco gasification process to EDS bottoms feedstocks in large-scale pilot units, and to develop specific design information and criteria over a range of bottoms to be used for the future construction of large-scale units. The specific objectives were: (1) To gasify two different EDS vacuum bottoms in the Texaco gasification pilot units operated by the TVA in Muscle Shoals, Alabama, and by Ruhrokohle AG/Ruhrchemie AG in Oberhausen-Holten, West Germany. (2) To obtain process and plant performance data to verify the applicability of the Texaco gasification process to EDS vacuum bottoms. (3) To carry out an environmental testing program by collecting and analyzing samples of waste water, solid discharges, and product gas while gasifying EDS vacuum bottoms in order to address environmental issues in the design and operation of a future, large-scale, commercial gasification unit. This report consists of (1) a report prepared by the Tennessee Valley Authority on the gasification of EDS vacuum bottoms made in ECLP from Illinois No. 6 coal in TVA's Ammonia from Coal Facility, (2) a report prepared by Texaco, Inc. on the EDS bottoms gasification test run at TVA, (3) a report prepared by Ruhrkohle AG/Ruhrchemie AG on the gasification test run with EDS vacuum bottoms made in ECLP from Texas Lignite in Ruhrkohle/Ruhrchemie's Texaco Coal Gasification Plant, (4) a report prepared by Texaco Development Corporation on the results of a feasibility study of the gasification of EDS vacuum bottoms in the Texaco Coal Gasification Process, and (5) a report prepared by ER & E on the Emissions Characterization Program.

45934 **(DOE/ET/10532—T26) Refining and upgrading of synfuels from coal and oil shales by advanced catalytic processes. Quarterly report, April-June 1985.** Sullivan, R.F. (Chevron Research Co., Richmond, CA (USA)). Aug 1985. Contract AC22-76ET10532. 16p. (FE—2315-120). NTIS, PC A02/MF A01; GPO Dep. File Number DE85017111.

Two Interim Reports were issued this quarter: (1) The Tenth Interim Report, DOE/ET-10532-T23, "Revised Stock Balances and Updated Cost Estimates," updates the costs of refining syncrudes estimated under this contract from 1978 through 1984 for the refining of shale oil, SRC-II oil, H-Coal oils, and EDS oil. The report revised all the previous results to a common, consistent basis suitable for use in internal comparisons; and (2) The Eleventh Interim Report, DOE/ET-10532-T25, "Refining of Illinois ITSL Oil: Experimental Studies," summarizes the results of laboratory and pilot plant studies to upgrade syncrude from the Integrated Two-Stage Liquefaction (ITSL) Process to transportation fuels. This quarterly report briefly summarizes results given in The Eleventh Interim Report, and presents supplementary experimental results from pilot plant tests on refining of Wyodak ITSL oil. 4 figs., 2 tabs.

45935 **(DOE/ET/10592—T1) Research and development of an advanced process for the conversion of coal to synthetic gasoline and other distillate fuels. Quarterly technical progress report No. 11, October-December 1979.** Schneider, A.; Hollstein, E.J.; Janoski, E.J.; Scheibel, E.G. (Suntech, Inc., Marcus Hook, PA (USA). Research and Engineering Div.). Aug 1980. Contract AC22-76ET10592. 51p. (FE—2306-44-Draft; ARD—2890-Draft). NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85017622.

We conclude from our present work that: (1) continuous liquid extraction of coal liquids is a unique, flexible, and valuable process which can aid in the production of gasoline and other valuable products; (2) continuous liquid extraction of coal liquids can be carried out to produce raffinate and extract product pf predictable nitrogen and oxygen content; (3) extraction of coal liquids primarily removes phenolic material. Extraction of as little as 15 wt % produces a raffinate product which hydrodenitrogenates at a rate about six times faster than non-extracted coal liquids. The data suggest that extraction can result in increased catalyst life, higher selectivity and efficiency and lower hydrorefining temperature; (4) the raffinate product is 80 to 90 wt % aromatic; (5) reaction pressure exerts an unexpectedly great influence on the quality of the product of raffinate hydrorefining; (6) both liquid extraction and hydrotreatment are required to produce a good catalytic cracking stock from coal liquids; (7) hydrorefining of the whole extract product is extraordinarily difficult and deteriorates the catalyst; (8) the data suggest that other uses be made of the extract produce such as feed to hydrogen production or chemical recovery; and (9) residual dimethylformamide (DMF) caused the methane to be produced in extract hydrorefining. 5 figs., 12 tabs.

45936 **(DOE/ET/10592—T2) Research and development of an advanced process for the conversion of coal to synthetic gasoline and other distillate fuels. Quarterly technical progress report No. 12, for the period October 1980-December 1980. Draft.** Schneider, A.; Hollstein, E.J.; Phillips, G.S.; Scheibel, E.G. (Suntech, Inc., Marcus Hook, PA (USA). Research and Engineering Div.). Feb 1981. Contract AC22-76ET10592. 30p. (FE—2306-48-Draft; ARD—2891-Draft). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85017623.

We conclude from our present work that: continuous liquid extraction of SRC-II middle distillate with aqueous methanol is well-understood and can be practiced to produce raffinate and extract products of predictable nitrogen and oxygen content; compared to extraction with dimethylformamide (DMF)-heptane, extraction of SRC-II middle distillate with aqueous methanol removes only about one-half as much oxygen- and nitrogen-containing material at an equivalent degree of extraction; extraction of about 25 wt % of SRC-II middle distillate produces double the hydrodenitrogenation rate constant of the raffinate product. DMF-heptane extraction is much more effective; hydrotreatment of the unextracted SRC-II middle distillate at 400°C, 2500 psig, and 0.9 LHSV can remove about all of the nitrogen, oxygen, and sulfur but hydrogen consumption is about 2600 $SCFH_2/BBL$; in the continuous hydrorefining of SRC-II middle distillate, space velocity has the greatest effect and hydrogen pressure the least effect on nitrogen removal and hydrogen consumption. 9 figs., 8 tabs.

45937 **(DOE/ET/10592—T4) Research and development of an advanced process for the conversion of coal to synthetic gasoline and other distillate fuels. Draft quarterly technical progress report No. 13, January-March 1981.** Talbot, A.F.; Hollstein, E.H.; Phillips, G.S.; Scheibel, E.G. (Suntech, Inc., Marcus Hook, PA (USA)). Sep 1981. Contract AC22-76ET10592. 41p. (FE—2306-51-Draft; ARD—2892-Draft). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85017624.

Suntech, Inc. conducted continuous hydrotreatment studies to compare the refining of middle distillate product from the SRC-II coal liquefaction process by two alternative processing routes. These routes consist of: Case 1. Hydrotreating of the whole, unextracted SRC-II middle distillate product; Case 2. Aqueous methanol extraction of a portion of the phenolics from the SRC-II middle distillate, followed by hydrotreating of the raffinate product from the extraction. These studies indicate a significant decrease in hydrogen consumption and a very slight increase in the rate of nitrogen removal, for processing via Case 2 as compared to processing via Case 1. Economic comparison of the two processing cases is inappropriate until the value of the extract produced in Case 2 is established. Parametric studies were performed for both feedstocks over ranges of temperature, pressure, and liquid hourly space velocity. The effect of these variables on nitrogen content of the liquid product and hydrogen consumption has been determined. Material balance calculations indicate that about 19 wt. % had been extracted from the SRC-II middle distillate to supply raffinate used in the above Case 2 studies. About half of the phenolics were left in the raffinate. If total removal of phenolics were desired, the extraction conditions could be modified. A hexane or heptane stripping step might also be desirable to reduce neutral oils in the extract product. 16 figs., 4 tabs.

45938 **(DOE/ET/14700—T1-Vol.4) Chemistry and catalysis of coal liquefaction: catalytic and thermal upgrading of coal liquids: and hydrogenation of CO to produce fuels. Volume IV. Final report.** Wiser, W.H. (Utah Univ., Salt Lake City (USA). Dept. of Fuels Engineering). 15 Jun 1985. Contract AC22-79ET14700. 154p. NTIS, PC A08/MF A01; GPO Dep. File Number DE85014169.

This research project was concerned with a systematic catalytic cracking investigation of hydrotreated coal-derived liquids and related model compounds found in such liquids. The studies were performed in a flow reactor, using REY-type zeolite-containing catalysts, in particular, Mobil Durabead-8. The following types of starting feedstocks were employed: (1) polycyclic naphthalenes, viz., decalin and perhydrophenanthrene; (2) polycyclic naphthenoaromatics, viz., tetralin, 1,2,3,4,5,6,7,8-octahydroanthracene and 9,10-dihydro phenanthrene; and (3) hydrotreated SRC-II liquids. Changes in product composition as a function of experimental variables (temperature, space velocity and catalyst type) were investigated and mechanistic aspects of the cracking reactions elucidated. 85 refs., 61 figs., 32 tabs.

45939 **(DOE/ET/14700—T1-Vol.5) Chemistry and catalysis of coal liquefaction: catalytic and thermal upgrading of coal liquids: and hydrogenation of CO to produce fuels. Volume V. Final report.** Wiser, W.H. (Utah Univ., Salt Lake City (USA). Dept. of Fuels Engineering). 15 Jun 1985. Contract AC22-79ET14700. 253p. NTIS, PC A12/MF A01. File Number DE85014170.

This project was concerned with a systematic study of the kinetics of hydrogenation-hydrodenitrogenation (HDN) reactions of condensed carbocyclic-N-heterocyclic model compounds, and of a representative coal liquid. The feeds investigated included 5,6-benzoquinoline; 7,8-benzoquinoline; phenanthridine (3,4-benzoquinoline); N-ethylcarbazole; carbazole; 1,10-phenanthroline; and a SRC-II middle-heavy distillate (b.p. 230 to 430°C). The studies were performed in autoclave reactors in the temperature range of 80 to 375°C, using sulfided $CoMo/\gamma\text{-}Al_2O_3$ and $NiMo/\gamma\text{-}Al_2O_3$ as catalysts. Changes in product composition as a function of experimental variables (reaction time, reaction temperature, catalyst type, and $H_2S$ ($CS_2$) concentration) were determined. Kinetic rate constants for each step in the reaction networks of the different model reactions were calculatd, and mechanistic aspects of the hydrogenation-HDN reactions were elucidated. 124 refs., 77 figs., 71 tabs.

45940 **(DOE/FE/05123—1879) Steam pyrolysis of coal for two-stage gasification.** (Avco-Everett Research Lab., Inc., Everett, MA (USA)). Jun 1985. Contract AC21-81FE05123. 155p. NTIS, PC A08/MF A01; GPO Dep. File Number DE85012192.

In a series of pyrolysis experiments prior to this program, it was shown that up to 80% of the carbon in coal could be liberated as volatile matter in less than 100 msec. The objective of this program was to maximize the yield of product gas produced by steam pyrolysis of coal in a flow reactor at residence times less than 0.1 sec. Experiments were carried out in a high-throughput (1/2 - 1 ton coal/hr) flow facility consisting of a combustor (operating on fuel oil) with outlet temperature 2450 - 2600K followed by a pyrolyzer section into which pulverized coal was injected. Product composition (with axial and radial resolution) and gas temperature were measured, and char samples were obtained for subsequent analysis. Particle size, coal loading, steam loading and $CO_2/H_2O$ ratio in the background gas were varied. The results show that the pyrolysis reactions are very rapid, with most of them completed within 10 msec. The results are in agreement with our coal gasification model at low coal loadings. At high coal loading, the char analysis remains consistent with the model, but the gas analysis data diverge, indicating the possibility of cracking reactions, stabilization vs cracking, to maximize the yield of useful products. 8 refs., 58 figs.

45941 **(DOE/FE/60181—165) Gasification of low-rank coals: technology status and recent research.** Wiltsee, G.A.; Willson, W.G. (North Dakota Univ., Grand Forks (USA). Energy Research Center). 1985. Contract FC21-83FE60181. 41p. (CONF-8510148—1). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85017463.

From Korea-U.S.A. coal utilization technology workshop; Seoul, Korea (14 Oct 1985).

Technology for gasification of low-rank coals includes processes that are commercially available as well as some that are being developed. Commercial Lurgi technology is being utilized by the Great Plains Gasification Associates (GPGA) to convert North Dakota lignite to high-Btu pipeline gas. Technically, this project has been quite successful in its design, construction, startup and initial operating phases. An advanced version of the Lurgi fixed bed gasifier, which operates in a slagging mode rather than dry bottom, is being offered commercially by British Gas Corporation (BGC). Independently, the US Department of Energy (DOE), at the University of North Dakota Energy Research Center (UNDERC), has successfully operated a 24-ton/day slagging fixed-bed gasifier on lignite. One key aspect of this fixed-bed gasification technology - wastewater treatment - has been the subject of significant recent re-

search sponsored by DOE. As part of this program, UNDERC has conducted pilot and bench scale studies on treatment of process water from fixed-bed gasification of lignite, and on reuse of the treated water in a cooling tower. With DOE funding, UNDERC has developed a process that can produce concentrated fuel slurries from low-rank coals by hydrothermal treatment. In a project funded by the Electric Power Research Institute, UNDERC is adapting this process for use with the Texaco gasifier. Another low-rank coal gasification research project being conducted at UNDERC with DOE funding aims to take advantage of the high reactivity, moisture content, and alkali content of these coals to produce hydrogen in a low-cost catalytic gasification process. UNDERC's kinetic studies of steam/char gasification in the presence of sodium or potassium catalysts have shown that conversion rates for lignites are significantly higher than those reported for high-rank coal. 28 refs., 5 figs., 7 tabs.

45942 **(DOE/MC/19208—1891) Studies in tar formation and separation in coal gasification systems. Final technical report.** Mahalingam, R. (Washington State Univ., Pullman (USA). Dept. of Chemical Engineering). Aug 1985. Contract AC21-82MC19208. 287p. NTIS, PC A13/MF A01; 1; GPO Dep. File Number DE85013683.

Devolatilization behavior of a subbituminous and a bituminous coal in relation to tars evolution was studied in a laboratory simulated devolatilization section of an air-blown Lurgi-type gasifier. The temperature range studied was 350° to 550°C, at pressures of 30, 300 and 375 psig. The feed gas was a synthetic mixture of composition similar to that leaving the gasification zone of a fixed bed gasifier and contained 30% by volume of steam. The tar samples collected were analyzed on a capillary GC for individual components and thirty such components were quantified; these included aromatic and aliphatic homologues, and also sulphur and nitrogen substituted structures. The molecular weights of tar samples showed a maximum between 300 and 500. The tar yields were higher for the mixed gas stream (reactive gas) than for the helium blank runs case. In the case of the bituminous coal, the devolatilization resulted in more than double the amount of tar as compared to that from the subbituminous coal, for both types of gas streams. A typical set of runs were carried out in order to evaluate the catalytic and thermal cracking of the tars present in the gasifier off-gas stream; the cracking referred to here is essentially hydrocracking, in view of the considerable amount of hydrogen present in the gas stream. The catalyst evaluated for tar cracking was a commercial cobalt-molybdenum catalyst, supported on $\gamma$-$Al_2O_3$. In the presence of the cracking unit, the rates of evolution of methane and propylene showed a small increase; there was a decrease in the amount of tar obtained; and the concentrations of the higher-ringed structures appeared to be lowered, thus, cracking could become beneficial in downstream processing. Finally, scrubbing experiments were carried out on the hot gas/tar stream evolved from the simulated devolatilization section.

45943 **(DOE/MC/20417—1745) Novel sorbents for high temperature regenerative $H_2S$ removal. Quarterly report No. 2, January-March 1984.** Flytzani-Stephanopoulos, M.; Gavalas, G.R.; Tamhankar, S.S. (Jet Propulsion Lab., Pasadena, CA (USA)). May 1984. Contract AI21-83MC20417. 41p. (JPL/D—1653). NTIS, PC A03/MF A01; GPO Dep. File Number DE85007314.

The overall objective of this project is to develop regenerable sorbents for fuel gas desulfurization at an operating temperature of 550 to 750°C. Two classes of sorbents are being investigated for removal of $H_2S$ from about 1 vol % to sub-ppM levels. The rapid absorption kinetics are realized by eliminating or minimizing the resistance associated with solid state diffusion. The main tasks planned for the second quarter of this project were: (1) limited parametric performance evaluation and completion of testing of the supported molten ZnO-$V_2O_5$ sorbents; and (2) development of a preparation technique and limited testing of high surface area, bulk metal oxide solid solutions. Experiments with the alumina-supported ZnO-$V_2O_5$ sorbents produced the following results. When the reactant gas did not contain $H_2O$ (dry conditions), sulfidation at 700°C proceeded up to 80% conversion (based on ZnO) before breakthrough. This sulfidation capacity was maintained in several cycles of successive sulfidation/regeneration and no evaporative loss of Zn was observed. However, in sorbents containing only ZnO on alumina (no vanadium), zinc was lost by evaporation under the same sulfidation conditions. Apparently, the vanadium stabilized the zinc in the support. In addition to its stabilization role, vanadium oxide provides considerable additional $H_2S$ removal capacity (20% of total) by means of chemisorption. This has been demonstrated in separate runs with alumina impregnated with $V_2O_5$ only (no zinc). The important finding from these tests is that no stable vanadium sulfides are formed during sulfidation; instead, $H_2S$ is chemisorbed on a reduced vanadium oxide, and can be fully retrieved in nitrogen purge following sulfidation. In the second class of sorbents, a number of preparations were attempted with the Zn-Fe-O system. Results are discussed. 16 refs., 9 figs., 5 tabs.

45944 **(DOE/MC/20417—1747) Novel sorbents for high temperature regenerative $H_2S$ removal. Topical report, October 1983-July 1984.** Flytzani-Stephanopoulos, M.; Gavalas, G.R.; Tamhankar, S.S. (Jet Propulsion Lab., Pasadena, CA (USA)). Jul 1984. Contract AI21-83MC20417. 60p. (JPL/D—1750). NTIS, PC A04/MF A01; GPO Dep. File Number DE85007311.

The overall objective of this project is to develop regenerable sorbents for fuel gas desulfurization at an operating temperature of 550 to 750°C. Two classes of sorbents are being investigated for removal of $H_2S$ from about 1 vol % to sub-ppM levels. The main characteristics of these sorbents are rapid kinetics of absorption and good regenerability. The rapid absorption kinetics are realized by eliminating or minimizing the resistance associated with solid state diffusion. With these properties, the sorbents would be suitable for coal gasification/molten carbonate fuel cell (MCFC) applications, but could also be applied to combined cycle power generation and the purification of synthesis gas. Work in Phase I was divided into two major tasks. The first task was to synthesize and test sorbents consisting of supported melts of binary oxides, particularly ZnO-$V_2O_5$ on high surface area supports. The second task involved the synthesis, characterization and testing of unsupported binary oxides such as ZnO-$Fe_2O_3$ in the form of porous solid compounds or solid solutions of relatively high surface area. In general, the results from Phase I of this project have demonstrated the importance of the physical properties of sorbents for improved stable performance, and have identified new materials with superior sorbent properties both at lower (538°C) and higher (700°C) operating temperatures. Among the several $H_2S$ sorbent systems that were tested, the novel copper and zinc ferrite materials from class B and the $CuMoO_4$-$MoO_3$/alumina from class A have shown the most promising performance. These will be studied in more detail during Phase II of this work. 16 refs., 17 figs., 8 tabs.

45945 **(DOE/PC/60047—T8) Advanced research for the characterization of hydrogen donor solvents in two-stage liquefaction. Quarterly report, April 1-June 30, 1985.** Chillingworth, R.S.; Potts, J.D. (Cities Service Research and Development Co., Tulsa, OK (USA)). 1985. Contract AC22-83PC60047. 38p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85017680.

The purpose of this research program is to develop an improved method for producing a highly effective solvent for the Integrated Two-Stage Liquefaction (ITSL) process and to study the characteristics of the solvent at a variety of process conditions. The ITSL process for conversion of coal to distillate liquids combines Short Contact Time (SCT) hydroliquefaction and expanded bed hydrogenation and hydrocracking of the coal extract, either before or after deashing. Accomplishments for this period are as follows: Subtask 4.1 (Continuous SCT Extract Hydrogenation) was completed with the third 15-day continuous catalyst aging run. Katalco NM-506 Ni/Mo catalyst was used to hydrogenate an Illinois 6 derived extract to a level of 7.5 to 7.9 weight percent hydrogen. A portion of the product samples were fractionated to 850°F- and 850°F+ components for use in Subtask 4.3 with the remainder of the products being blended into one large batch for Subtask 4.2. Three 14-day continuous hydrocracking runs were completed for Subtask 4.2 (Continuous Hydrocracking of Hydrogenated SCT Extract). The catalysts used for these runs were: Shell 317 Ni/Mo, Katalco NM-506 Ni/Mo, and American Cyanamid 1442B Co/Mo. The operating conditions were 750°F, 775°F, and 800°F at 1.0 weight hourly space velocity. The conversion of 650°F+ material and 850°F+ material was monitored and compared between the

runs. Thirty-six microautoclave SCT runs were made using the hydrogen donor solvent from Subtask 4.1 products. The conversion of Illinois 6 coal was observed for each run and correlated with the solvent blending components and hydrogen contents (Subtask 4.3 - Microautoclave Tests using Solvents from Continuous Hydrogenation and Hydrocracking). 5 figs., 9 tabs.

45946 **(DOE/PC/60800—7) Active sites in char gasification. Quarterly technical progress report, 1 April 1985-30 June 1985.** Calo, J.M.; Suuberg, E.M.; Hradil, G.; Perkins, M.; Lilly, W. (Brown Univ., Providence, RI (USA). Div. of Engineering). 1985. Contract FG22-83PC60800. 20p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85017411.

This project is concerned with the study of the nature and behavior of "active sites" in the gasification of chars produced from synthesized model compounds, primarily those of the phenol-formaldehyde family of resins. One of the tasks defined for this project is to conduct transient kinetic studies on the gasification of these model compound chars. A new jet-stirred, pyro-gasifer reactor had to be developed for this purpose. Preliminary design considerations and calculations for this reactor were presented in the second quarterly technical progress report, and preliminary testing of the constructed reactor in the fifth quarterly technical progress report. Since that report, the reactor has undergone additional development and mixing characterization. The attainment and assurance of good mixing in the jet-stirred reactor is essential to applying well-mixed reactor kinetics models to the transient gasification experiments to be conducted with unlabeled and C-13 labeled model compound chars in order to determine active site behavior, concentration, and distribution, as discussed in the second quarterly technical progress report. The current quarterly technical progress report summarizes the work to data performed on this reactor. 5 figs., 1 tab.

45947 **(DOE/PC/70018—9) Coal liquefaction process solvent characterization and evaluation. Technical progress report, April 1-June 30, 1985.** Winschel, R.A.; Robbins, G.A.; Burke, F.P. (Conoco, Inc., Library, PA (USA). Coal Research Div.). Aug 1985. Contract AC22-84PC70018. 108p. NTIS, PC A06/MF A01; GPO Dep. File Number DE85017237.

This report includes results and interpretation of Conoco's analyses of sixty process oil samples from Wilsonville Run 247 operated from September, 1984, through January, 1985, in the RITSL mode with Illinois 6 bituminous coal. Characterization with particular emphasis on solvent quality of five samples from the Lummus fixed-bed hydrotreater program is presented. Results are included from a round-robin analytical program in which the phenolic contents of coal liquids were determined by several techniques. The appendix contains two reports, "Process-Oil Characteristics in Integrated Two-Stage Liquefaction - Comparison of PDU and Pilot Plant Operations with Bituminous Coal" and Phenolic-OH as a Process-Performance Indicator in Two-Stage Liquefaction". These reports have been processed separately for inclusion in the Energy Data Base. 12 refs., 4 figs., 32 tabs.

45948 (DOE/PC/70018—9, pp 84-95) **Process-oil characteristics in Integrated Two-Stage Liquefaction (ITSL): comparison of PDU and pilot-plant operations with bituminous coal.** Winschel, R.A.; Burke, F.P. Aug 1985. NTIS, PC A06/MF A01. File Number DE85017237. Contract AC22-80PC30027.

In Coal liquefaction process solvent characterization and evaluation. Technical progress report, April 1, 1985-June 30, 1985.

Recycle and other process oils taken during Integrated Two-Stage Liquefaction (ITSL) operations of Lummus' 30 lb/h process development unit (PDU) and the Wilsonville, AL, pilot plant (200 lb/h) were analyzed to compare the two ITSL operations. Samples were obtained from Lummus PDU Runs 3LCF7 (Indiana 5 coal), 3LCF8 and 3LCF9 (Illinois 6 coal), and Wilsonville pilot plant Run 242 (Illinois 6 coal). The process oils from pilot plant Run 242 are significantly different from the corresponding process oils from the Lummus PDU, although both were ITSL operations. Much of the difference may be ascribed to differences between the first-stage (thermal) severities and the selectivities of the deashing operations. Characteristics of the start-up solvents may also have influenced this comparison. Laboratory experiments showed that the second-stage residual feed to pilot plant run 242 was significantly less reactive toward conversion to distillate than the corresponding material from PDU Run 3LCF9 at thermal/donor, i.e., non-catalytic conditions, consistent with the process oil analysis. 13 refs., 1 fig., 1 tab.

45949 (DOE/PC/70018—9, pp 96-104) **Phenolic -OH as a process-performance indicator in two-stage liquefaction.** Robbins, G.A.; Winschel, R.A.; Burke, F.P. Aug 1985. NTIS, PC A06/MF A01. File Number DE85017237. Contract AC22-80PC30027.

In Coal liquefaction process solvent characterization and evaluation. Technical progress report, April 1, 1985-June 30, 1985.

Phenolic -OH concentrations were measured for process oil samples taken throughout the year-long Run 3LCF9 of the Lummus Integrated Two-Stage Liquefaction PDU, and a 25-day run of HRI's bench scale Catalytic Two-Stage Liquefaction process unit. The phenolic -OH concentration of the Lummus product resid responded to changes in catalyst age and space velocity. The phenolic -OH concentration of the HRI second-stage products also increased in response to catalyst age, the only process variable during that run. These results demonstrate that phenolic concentration is a sensitive indicator of coal liquefaction process performance. These data were obtained using a quantitative infrared spectroscopic method, applicable to tetrahydrofuran-soluble coal liquids, which permits analysis of the entire range of converted coal products. This analytical method is rapid, reproducible and accurate, and also provides qualitative information about the molecular structure of the phenolic components. 8 refs., 7 figs.

45950 **(DOE/PC/70786—T3) Transition metal catalysis of hydrogen shuttling in coal liquefaction.** Eisch, J.J. (State Univ. of New York, Binghamton (USA). Dept. of Chemistry). 30 Jul 1985. Contract FG22-84PC70786. 4p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016162.

The ultimate objective of this research is to uncover new catalytic processes for the liquefaction of coal and for upgrading coal-derived fuels by removing undesirable organosulfur, organonitrogen and organooxygen constituents. Basic to both the liquefaction of coal and the purification of coal liquids is the transfer of hydrogen from sources such as dihydrogen, metal hydrides or partially reduced aromatic hydrocarbons, to the extensive aromatic rings in coal itself or to aromatic sulfides, amines and ethers. Accordingly, this study is exploring how such crucial hydrogen-transfer processes might be catalyzed by soluble, low-valent transition metal complexes under moderate conditions of temperature and pressure. By learning the mechanism whereby $H_2$, metal hydrides or partially hydrogenated aromatics can transfer hydrogen to model aromatic compounds, we hope to identify new methods for producing superior fuels from coal. During the third quarter of this three-year grant the following aspects were pursued: (a) the appointment and start of work of the postdoctoral research associate, Dr. Tomasz Dluzniewski, have been made; (b) the Perkin-Elmer high performance liquid chromatograph, series 400, has been delivered and set up for operation; (c) the detailed manuscript reporting the desulfurizing action of the combination, $(Cod)_2Ni$, $LiAlH_4$ and bipyridyl, is in the course of completion; (d) experiments are in progress on the nickel-catalyzed hydrogen shuttling reactions of dihydroaromatics and cleavage reactions of benzylic C-C bonds; and (e) surveying the cleavage of carbon-heteroatom bonds by the combination, $(Cod)_2Ni$ $LiAlH_4$ and bipyridyl, continues.

45951 **(DOE/PC/70790—T3) Thermodynamic and transport properties for polar coal mixtures. Technical progress report, April 1-June 30, 1985.** Stiel, L.I. (Polytechnic Inst. of New York, Brooklyn (USA)). 1985. Contract FG22-84PC70790. 11p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85016263.

Experimental and theoretical work on the thermodynamic properties of coal liquids, including mixtures, is presented. The emphasis is on methods of calculations. (LTN)

45952 **(DOE/PC/71257—T3) Novel experimental studies for coal liquefaction. Quarterly progress report, April 1, 1985-June 30, 1985.** Holder, G.; Shah, Y.T.; Tierney, J.W. (Pittsburgh Univ., PA (USA)). 1985. Contract FG22-84PC71257. 6p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016181.

Progress reports are presented for the following two tasks: (1) thermal behavior of slurry reactors used in indirect coal liquefaction; and (2) coal liquefaction under supercritical condition. In Task 1, the slurry reactor has been modified to permit better control and measurement of the amount of liquid in the reactor, to simplify piping, and to improve instrumentation. Of particular interest is the determination of multiple steady states. Previous work with a ruthenium catalyst has shown that two distinct steady states can be found for identical operating conditions. Other catalysts and operating conditions are being studied. During the first part of Task 2, toluene, was studied to determine the effect of density on the coal extraction/reaction process. Extractions were carried out for 2 to 60 minutes at reduced densities between 0.5 and 2.0 and at temperatures between 647 and 698 K. The data obtained can be explained by the hypothesis that coal dissolution precedes liquefaction reactions and that the degree of dissolution depends upon solvent density and temperature. A kinetic model shows that higher solvent densities result in faster conversion rates and in higher total conversions. A second factor that makes supercritical extraction attractive is high mass transfer rates. At high pressures, mass transfer rates in a supercritical fluid are much higher than in a liquid. 2 figs.

45953 **(DOE/PC/79892—T3) Coal liquefaction study under the nonisothermal reaction temperature. Quarterly progress report, April-June 1985.** Kwon, K.C. (Tuskegee Inst., AL (USA). Dept. of Chemical Engineering). 1985. Contract FG22-84PC79892. 33p. NTIS, PC A03. File Number DE85016920.

During this quarter, effects of soaking temperatures on liquefaction of Kentucky No. 9 coal were investigated as part of the Task 1. Kentucky No. 9 coal (KY 9 coal) was soaked with 1-methylnaphthalene (1-MN) both in the presence of a hydrogen donor solvent and in the absence of a hydrogen donor solvent under a nitrogen atmosphere for 60 minutes at 250°C and 300°C. The soaked coal was liquefied with molecular hydrogen for 15 minutes at 380°C. The main objective of this research is to investigate effects of soaking temperatures on liquefaction of KY 9 coal in the presence of various hydrogen donor solvents. The liquefied coal solution was separated into a tetrahydrofuran-soluble fraction to obtain a product distribution in terms of preasphaltene, asphaltene, and oil-plus-water-plus-gas. Hydrogen donor solvents include quinoline 1, 2, 3, 4-tetrahydroquinoline, acridine, anthracene and dihydroanthracene. Results are discussed. 4 tabs.

45954 **(EPRI-AP—4227) Selective hydrogenation of polynuclear heteroatomic compounds. Final report.** Fish, R.H.; Heinemann, H. (Lawrence Berkeley Lab., CA (USA)). Aug 1985. Contract AC03-76SF00098. 41p. NTIS, PC A03/MF A01 - Research Reports Center, Box 50490, Palo Alto, CA 94303; GPO Dep. File Number DE85017581.

This research program focused on the utilization of polymer-supported (polystyrene-divinylbenzene, PS-DVB) transition-metal catalysts in the selective catalytic hydrogenation of polynuclear heteroaromatic compounds that are known to be present in coal and coal liquids. We found that the polymer-supported chlorotris(triphenyl-phosphine)rhodium(1) was the most efficient catalyst for the regiospecific reduction of the nitrogen-containing ring in model-coal compounds such as quinoline, 5,6- and 7,8-benzoquinoline and acridine, and in one case, a heteroaromatic sulfur compound, benzothiophene. Interestingly, the polymer-supported rhodium catalyst was more active than the corresponding homogeneous analogue by relative rate factors of 10 to 20 depending on the substrate studied in the reduction. More importantly, a model coal liquid was found to have a relative rate of reduction of quinoline to 1,2,3,4-tetrahydroquinoline (THQ) that was 2.2 times faster than a similar experiment without the coal liquid constituents consisting of pyrene, tetralin, methylnaphthalene, p-cresol, quinoline, and 2-methylpyridine. Further experimentation clearly showed that the model coal liquid constituent, p-cresol, was responsible for the relative rate enhancement in the highly regiospecific (no other model coal liquid constituent was hydrogenated) reduction of quinoline to THQ. We also found that 9,10-dihydrophenanthridine was an excellent catalytic transfer hydrogenation reagent in the presence of several homogeneous and polymer-supported transition-metal catalysts. A discussion demonstrates the potential usefulness of these catalysts in the hydroprocessing of coal liquids and other petroleum products.

45955 **(NP—5770362) New aspects in liquefaction experiments with brown coal/water suspensions.** Haeffner, E. (Technische Univ. Clausthal, Clausthal-Zellerfeld (Germany, F.R.). Fakultaet fuer Bergbau, Huettenwesen und Maschinenwesen). 21 Dec 1983. 119p. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE85770362.

The author investigated the hydrogenation of brown coal suspended in water in a continuous experimental facility at subcritical temperatures. Particular interest was taken in some of the technical and economic aspects, e.g. the increase of the raw lignite wax fraction and the improvement of the lignite wax quality as a result of hydrogenation effects. Means of increasing the yield of lignite wax materials from brown coal/water suspensions in continuous processes were studied. Also discussed were the conditions under which refining hydrogenation effects occur if CO is used as reaction gas and the possibility of obtaining commercially interesting amounts of hydrogen from CO also in the subcritical temperature range of brown coal/water suspensions. Apart from the methodological studies, mass balances are presented and the various processes are analysed.

45956 **(NP—5770371) Two-dimensional, two-phase model for hybrid simulation of allothermal coal gasification by means of water vapor in a fluidized-bed reactor.** Udaquiola de Garces, S.M. (Technische Hochschule Aachen (Germany, F.R.). Mathematisch-Naturwissenschaftliche Fakultaet). 24 May 1984. 170p. (In German). NTIS (US Sales Only), PC A08/MF A01. File Number DE85770371.

The projects currently under way include allothermal coal gasification by means of water vapor in a fluidized-bed reactor, which is being conducted at Bergbau-Forschung GmbH. In the framework of that investigation a mathematical model simulating the processes in and calculating the operational data of the above-mentioned fluidized-bed gasification reactor is developed and tested. The work aims to cover the gasification process by a two-dimensional, two-phase model - bubble phase and suspension phase - in order to improve it. Furthermore a hybrid computer is to be used for the simulation.

45957 **(SAND—85-0924C) Laboratory simulation of underground gasification of Eastern bituminous coals.** Tyner, C.E.; Skocypec, R.D.; Cook, D.W.; Engler, B.P. (Sandia National Labs., Albuquerque, NM (USA)). 1985. Contract AC04-76DP00789. 14p. (CONF-8508101—2). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85017000.

From 11. annual underground coal gasification; Denver, CO, USA (11 Aug 1985).

In support of the Department of Energy's Eastern Underground Coal Gasification (UCG) program, we are conducting a series of small-scale laboratory gasification experiments. The purpose of these experiments is to develop a better understanding of the gasification process in Eastern bituminous coals, particularly as it differs from that previously observed in Western sub-bituminous coals. The results of this work will be used as input to both our modeling efforts and to upcoming field tests. We have to date conducted gasification experiments using both a Western subbituminous coal (for reference) and an Eastern bituminous coal (Illinois Herrin No. 6, from the site of the proposed field tests). The sub-bituminous coal exhibited the same phenomena observed in field tests, including high char reactivity, low structural strength, and cavity growth dominated by thermal-mechanical mechanisms. The bituminous coal experiments, on the other hand, were difficult to ignite and showed much lower char reactivity and much higher mechanical strength. Initial cavity growth was controlled by char reaction mechanisms rather than coal roof spalling. These results suggest that achieving enhanced char combustion and gasification rates is critical to the success of bituminous UCG. 8 refs., 15 figs., 4 tabs.

45958 **(SAND—85-7200C) Impact of rank-related coal properties on the response of coals to continuous direct liquefaction processes.** Tomlinson, G.; Gray, D.; Neuworth, M. (Mitre Corp., McLean, VA (USA)). 1985. Contract AC04-76DP00789. 9p. (CONF-851003—4). NTIS, PC A02/MF A01; GPO Dep. File Number DE85012839.

From Conference on coal science; Sydney, Australia (28 Oct 1985).

The results of processing coal of various rank in continuous flow coal liquefaction processes are reviewed in an effort to correlate liquefaction process requirements to rank-related coal properties. The results show markedly different trends than have been shown in correlations based on batch processing. Younger coals are more difficult to dissolve, but produce excellent oil yields at relatively low hydrogen consumption when processed in appropriately catalyzed continuous flow processes employing a recycle of undissolved bottom material to the dissolver. 1 ref., 1 fig., 2 tabs.

45959 **(SAND—85-7211) Fundamental aspects of primary coal liquefaction.** Neuworth, M.B.; Gray, D. (Mitre Corp., McLean, VA (USA). METREK Div.). Aug 1985. Contract AC04-76DP00789. 213p. NTIS, PC A10/MF A01; 1; GPO Dep. File Number DE85017874.

Literature pertaining to physical and chemical aspects of solvent and coal interaction during primary coal dissolution is reviewed. These interactions were examined in detail and correlated with accepted views of the physical and chemical structure of coal, in order to develop new insights into the primary dissolution phenomena. The potential importance of physical interaction between coal and solvent at relatively low temperature (150 to 300°C) in terms of ultimate behavior during liquefaction and the lack of detailed experimental testing were highlighted. The complexities of donor solvent chemistry and the potential multiple role of individual solvents were identified. Areas for research to improve our understanding of this complex primary dissolution process were defined. 92 refs., 57 figs., 13 tabs.

45960 **(UCRL—92488) Modeling thermal and material interactions between a reacting char bed and a gasifying/spalling coal proof.** Britten, J.A.; Thorsness, C.B. (Lawrence Livermore National Lab., CA (USA)). Aug 1985. Contract W-7405-ENG-48. 17p. (CONF-8508101—3). NTIS, PC A02/MF A01; GPO Dep. File Number DE85017101.

From 11. annual underground coal gasification; Denver, CO, USA (11 Aug 1985).

Spalling of coal particles from a coal roof into a char rubble bed where they are gasified by injected oxygen and steam is a documented mechanism for growth of an underground coal gasification (UCG) cavity. A one-dimensional model has been developed which quantifies radiant and convection heat transport and carbon transport between a reacting, settling char bed and an overlying coal roof subject to drying, pyrolysis, gasification and spalling, to determine conditions for quasi-steady operation of the coupled system. The model is formulated in terms of two parameters characterizing the rock-mechanics of the problem; an average failure length and failure temperature for the roof coal. By use of reasonable simplifying assumptions, the balance equations in the char bed are solved analytically, and an extinction temperature for the char/steam reaction in the bed is derived in the limit of a large activation energy for this reaction. Results of a numerical transient heat penetration/spalling model for the roof are averaged over the spalling time, and coupled to the char bed system. The method of activation energy asymptotics is used to derive an algebraic expression for the roof recession velocity due to gasification by steam evaporating from the coal interior. Results show that while the failure parameters significantly influence the cavity temperature and the mechanism of roof growth, the roof growth rate is determined to a large extent only by the flux of oxygen in the char bed. Injected gas composition has a minor influence on the roof recession, and for many conditions encountered in-situ, injected steam acts only as a diluent and does not appreciably affect the carbon conversion rate. These results may help to explain the observation from UCG field test results that cavity growth rates seem to be relatively insensitive to a number of influences. 34 refs., 10 figs., 2 tabs.

45961 **(BG-Trans—7196) Process for recovering the salts of anthraquinonedisulphonic acid from a washing liquid stream.** (British Gas Corp., London; Linde A.G., Wiesbaden (Germany, F.R.)). 17 Jun 1985. Translation of European Patent EP 0 014 950 B1, May 12, 1982. 11p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85902104.

The invention concerns a process for recovering the salts of anthraquinone disulphonic acid (ADA) from a sub-stream of washing liquid. In the so-called Stretford process, an alkaline solution of salts of anthraquinone disulphonic acid (ADA) is used as a washing liquid, for washing hydrogen sulfide from gases or gas mixtures which contain it. The alkaline component is normally sodium carbonate. In a modern variant of the Stretford process, sodium metavanadate is added to accelerate certain partial reactions. In an initial, relatively very fast reaction step, sodium hydrogen sulfide is formed by reaction between the hydrogen sulfide and the sodium carbonate, from which elementary sulfur is then liberated by reduction of the oxidation state of the vanadium from +5 to +4, along with the formation of caustic soda. The anthraquinone disulphonic acid salt now acts, along with the effect of the caustic soda, to restore the vanadium to its original oxidation state. The anthraquinone disulphonic acid salt which is reduced in this way - in general the sodium salt is used - is then re-oxidized by addition of oxygen, normally in the form of air. The purpose which forms the basis of the invention is, therefore, to provide a process of the type stated at the beginning, which makes it possible to recover the valuable salts of anthraquinone disulphonic acid in a simple and economical way. Further, the process steps which have to be carried out should, as far as possible, be integrated into the overall process. It turned out that the retention of the salts of anthraquinone disulphonic acid is based on (due to) the macroporous structure of the adsorber resins.

45962 **Reactions of coal and model coal compounds in room temperature molten salt mixtures.** Newman, D.S.; Winans, R.E.; McBeth, R.L. (Argonne National Lab., IL). *Journal of the Electrochemical Society;* **131**: No. 5, 1079-1083(May 1984).

From Meeting of the Electrochemical Society; Hollywood, FL, USA (5-10 Oct 1980).

A 2:1 $AlCl_3$-pyridinium chloride molten salt solution was used as the reaction medium for the alkylation of diphenylethane and a bituminous coal by 2-propanol. Probably accompanying the room temperature Friedel-Crafts alkylation is a reduction of C=O to -C-OH. Completely deuterated 2-propanol did not react at all with the pyridinium ring. The pyridinium chloride serves to lower the temperature at which the $AlCl_3$ is able to catalyze the reactions. The pyridinium chloride also catalyzes the Friedel-Crafts alkylation.

45963 **(BG-Trans—07096) Rectisol process for the purification of compressed gases.** Herbert, W. Translated from *Erdoel und Kohle ;* 9: No. 2, 77-81(1956). 17p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85902085.

This translation is a detailed description of the RECTISOL process for purifying compressed synthetic or natural gas. It is effective in removing several impurities at the same time. Details of the process which makes it economically effective are explained. (LTN)

## 0105 By-products

*REFER ALSO TO CITATION(S) 46041*

45964 **(STEV-FBA—85-14) Peat ashes as manure in forestry.** Holmen, H. (Statens Energiverk, Stockholm (Sweden)). 1985. 10p. (In Swedish). NTIS (US Sales Only), PC A02/MF A01. File Number DE85752549.

The reported facts are based upon field experiments and analytical data environmental effects are not discussed. The share of fertilized forest on peat land is very small in Sweden, about 1000 ha of totally 150000 ha fertilized forest. When fertilizing with peat and wood ashes, potassium and phosphorous will be supplied to the soil. Large amounts of ashes are needed. More than one million ha of peat land could be fertilized, the necessary amount being at least

ten million ton of ashes. This means that ashes cannot compete with artificial fertilizers.

## 0106 Properties

*REFER ALSO TO CITATION(S) 45947, 45948, 45949, 45951, 46003, 46037, 46038, 46264*

45965 **(DOE/ET/10592—T3) Research and development of an advanced process for the conversion of coal to synthetic gasoline and other distillate fuels. Quarterly technical progress report No. 14, April-June 1981.** Talbot, A.F.; Hollstein, E.J.; Phillips, G.S. (Suntech, Inc., Marcus Hook, PA (USA). Applied Research and Development Dept.). Nov 1981. Contract AC22-76ET10592. 54p. (FE—2306-54-Draft; ARD—2893-Draft). NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85017625.

Summary of progress to date are as follows: (1) An improved procedure for analyzing extract products and distillate fractions of SRC-II liquids has been developed. It provides data on amine and neutral oil content, as well as phenols concentration. (2) Analyses showed that SRC-II liquids are rich sources of phenol, cresols, and xylenols. Over 95% of the phenols are contained in an SRC-II fraction which has a boilding range of 255°F to 550°F. (3) The large batch of raffinate, prepared by methanol extraction of SRC-II middle distillate for the continuous hydrotreating studies, contained about 14 wt % phenols. Thus, the extraction removed about 58 wt % of the available phenols. (4) Bench scale studies compared the hydrotreatment of the as-received SRC-II middle distillate and the raffinate from methanol extraction. These indicate an advantage for the latter, in terms of hydrogen consumption and reaction conditions to achieve comparable product quality level. (5) The reaction rate data from hydrotreating the two feedstocks were reevaluated assuming a first order reaction mechanism. Within the precision of the data, rate constants for both nigrogen removal and oxygen removal were comparable for the two feedstocks. (6) Additional analyses of the liquid products from the hydrotreating of the two feedstocks indicate most of the characteristics are consistent with changes in the degree of saturation of the aromatics structure. The distribution of naphthenes in the product reflects the fact that the extraction removed principally single ring phenolics from the middle distillate. (7) Preliminary engineering design bases were started, in anticipation of the engineering and economic analysis of the effect of extraction prior to hydrotreating, for the SRC-II middle distillate. 16 figs., 9 tabs.

45966 **(DOE/ET/10592—T5) Research and development of an advanced process for the conversion of coal to synthetic gasoline and other distillate fuels. Quarterly technical progress report No. 15, July 1981-September 1981.** Talbot, A.F.; Hollstein, E.J. (Suntech, Inc., Marcus Hook, PA (USA). Applied Research and Development Dept.). Jan 1982. Contract AC22-76ET10592. 55p. (FE—2306-57-Draft; ARD—2895-Draft). NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85017626.

This report describes progress, during the period July 1, 1981 through September 30, 1981, in the development of techniques for the upgrading of coal liquids by the application of extraction technology. Studies were conducted to determine the feasibility of removing phenols from SRC-II naphtha and middle distillate by aqueous methanol extraction. Extraction feedstocks were prepared by mixing SRC-II naphtha and middle distillate and distilling into narrow boiling fractions. The fractions were analyzed so that phenols and nitrogen boiling range profiles could be determined. The phenols were found to be concentrated in the 280°F to 500°F fraction, while the nitrogen content generally increased throughout the boiling range. One-step and multi-stage laboratory batch extraction tests were first conducted to determine operating parameters. Then, continuous, frational extractions were carried out in a Scheibel extraction column. The work demonstrated that the phenols can be extracted efficiently and selectively from the appropriate phenols-containing heart cut. 15 figs., 15 tabs.

45967 **(DOE/ET/13378—T1) Structures of coal: new approache: to characterizing organonitrogen and organosulfur functionalities. Final report.** Cooks, R.G. (Purdue Univ., Lafayette, IN (USA). Dept. of Chemistry). 1980. Contract AC22-78ET13378. 88p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE85017621.

This report describes the application of new analytical methods in the characterization of coal-related materials. The methods, which had previously been developed in these and other laboratories, are variants of mass spectrometry which itself has unique sensitivity as well as excellent compound specificity but is restricted to pure compounds unless coupled with a method of separation such as gas chromatography. The materials of most interest were coal liquids, although some work with coal was also done. The technique of mass spectrometry/mass spectrometry (ms/ms), which employs a tandem instrument and allows individual constituents of complex liquids to be examined without pretreatment, was the focus of attention. A particular ms/ms instrument, the mass-analyzed ion kinetic energy spectrometer (MIKES) was computerized as part of this project in order to be able to manage the large amounts of data genetrated from such complex mixtures as coal liquids. A solvent refined coal (SRC) sample was searched for particular constituents, for homologous series and for previously unencountered compounds. A variety of ionization methods and spectral scanning methods were employed to maximize the specificity of ms/ms and minimize analysis times. Some new ms/ms procedures were developed in the course of this work, including a procedure which highlights nitrogen containing compounds and also the important neutral loss or functional group scan procedure which facilitates identification of classes of compounds, rather than targeting the search on individual compounds. Applications of functional group scans to various classes of compound have been made. Detection limits of ms/ms, quantitative determinations by standard addition procedures and the isomer specificity of the methodology, were all matters on which information was obtained. 27 refs., 37 figs.

45968 **(DOE/FE/60181—116) Characterization of the components of lithologic layers of North Dakota lignites.** Schobert, H.H.; Karner, F.R.; Kleesattel, D.R.; Olson, E.S. (North Dakota Univ., Grand Forks (USA). Energy Research Center). 1985. Contract FC21-83FE60181. 6p. (CONF-851003—5). NTIS, PC A02/MF A01; GPO Dep. File Number DE85013126.

From Conference on coal science; Sydney, Australia (28 Oct 1985).

Lignites of the northern Great Plains (USA) exhibit distinct lithologic layering. Current geochemical research is directed to characterization of the separable components of the lithologic layers - the lithotypes fusain, vitrain and attritus, and their constituent macerals. The lithotype compositions plotted on a ternary bond equivalence diagram (Battaerd and Evans, 1979) show a relationship between the medium dark, medium light, and dark lithotypes of Victorian brown coal (data from Johns and others, 1984) and attritus and fusain in the lignite. These five lithotypes seem to be related, in the order listed, by increasing loss of cellulose, lignin or both. Furthermore, a linear correlation (r = .85) exists between the percent carbon bond equivalence and aromaticity of the five lithotypes. Work currently in progress seeks to extend the understanding of the geochemical relationships among brown coal and lignite lithotypes. 15 refs., 1 fig., 1 tab.

45969 **(DOE/MC/14101—1847) Gravity flow of solids engineering databook: measurement of surface moisture of coal. Final technical report.** Royal, T.M.; Costello, R.F. (Jenike and Johanson, Inc., North Billerica, MA (USA)). Sep 1984. Contract AC21-80MC14101. 111p. NTIS, PC A06/MF A01; GPO Dep. File Number DE85011277.

The purpose of this work was to search out different methods for determining surface moisture and to select the most promising for trial on three coal samples. At the same time these coals - a lignite, a western sub-bituminous and an eastern bituminous - were tested for flowability. All of the tests have been analyzed looking specifically for a good method of determining surface moisture and for any possible correlation between measured flow behavior and moisture measurements. None of the "typical" surface moisture

measurement techniques correlated with the measured cohesive behavior of the coals tested. In the case of the lignite and sub-bituminous coal tested the inherent moisture content (that is the total moisture content not affecting flow properties of coal) appears to be high. This means that the partial drying tests typically used to indicate surface moisture give high surface moisture values when none is present. Consequently there is little if any agreement in the values of surface moisture determined with the various techniques. In general, the only semi-reliable moisture measure of coal is the total moisture content. The only reliable way of determining the effect of moisture content on flow properties of a coal is to measure these properties at the total moisture content under consideration. If this is done for a range of total moisture contents it is possible to determine a maximum total moisture below which flow properties are unaffected by moisture. This total moisture then represents the zero surface moisture level of the coal. Surface moisture is any moisture above this level. 19 refs., 12 figs., 6 tabs.

45970 (DOE/METC—85/6018-Vol.1, pp 465-472) **Use and standardization of rapid test methods for measuring the carbon content and fineness of fly ash pozzolan.** Hooton, R.D.; Buckingham, J.H.P. (Ontario Hydro, Toronto). May 1985. NTIS, PC A21/MF A01. File Number DE85008620. (CONF-850304—Vol.1).

From 7. international symposium on ash utilization; Orlando, FL, USA (4 Mar 1985).

Loss on ignition and fineness are two of the most important fly ash properties for the concrete producer to know in order to adjust his mix proportions and admixture doses. However, these standard test values are not usually available in time to allow adjustments to the concrete mix proportions. In Ontario Hydro a Leco carbon analyzer and an Alpine air-jet siever have been employed as rapid test alternatives. Results are given to the truck driver only a few minutes after the tanker is filled. These rapid methods to supply carbon and fineness measurements to customers with every truck load of fly ash pozzolan sold have been in place at the Lakeview generating station since 1975. Relationships between the current standard rapid test values are given together with recommendations for adoption of these rapid tests as alternative methods to the standards. 5 references.

45971 (DOE/PC/50801—11) **Laser induced coal fluorescence. Eleventh quarterly technical progress report, April 1-June 31, 1985.** Borst, W.L. (Southern Illinois Univ., Carbondale (USA); Texas Tech Univ., Lubbock (USA)). 1985. Contract FG22-82PC50801. 8p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85016251.

The work performed during this period consisted of writing two papers, the submission of another, data acquisition of two major coal series, writing of additional software, transfer and subsequent setting up of lab equipment as a result of the move from Southern Illinois University to Texas Tech University. We are currently completing data acquisition and reduction on 20 crushed-particle pellets of two North American Carboniferous Coal seams (Hartshorne from Oklahoma and Lower Kittanning from Pennsylvania and Ohio). These pellets cover a rank range which extends from high-volatile bituminous to low-volatile bituminous. The time-resolved fluorescence properties are being studied as a function of rank and maceral type. For the high-volatile coals, the sporinite, cutinite, resinite, and fluorinite macerals are being investigated, while for the medium and low volatile bituminous coals, the secondary fluorescing macerals are studied. 5 figs.

45972 (DOE/PC/70754—T1) **Electrochemical hydrogenation and hydrogenolysis in aqueous media. Annual report, 1985.** Kariv-Miller, E. (Minnesota Univ., St. Paul (USA). Dept. of Chemistry). 1985. Contract RA22-84PC70754. 10p. NTIS, PC A02/MF A01. File Number DE85017208.

These studies with anthracene, phenanthrene and benzothiophene demonstrate that "Birch like" cathodic reduction of polycyclic aromatics is possible and good yields of highly reduced products are obtained. Two distinctive advantages of the cathodic method, as compared to solvated electron reductions, are that it uses water as the solvent and the hydrogen source, and that the product composition can be controlled by the amount of charge transferred. In addition to the convenient conditions, the results obtained with benzothiophene indicate that the cathodic reduction or reductive cleavage when both are possible reaction routes for a substrate.

45973 (IS-M—560) **Solvent swelling of Coal 1. Development of an improved method for measuring swelling phenomena.** Aida, T.; Squires, T.G. (Ames Lab., IA (USA)). 1985. Contract W-7405-ENG-82. 7p. (CONF-850417—28). NTIS, PC A02/MF A01; GPO Dep. File Number DE85017344.

From 189. national meeting of the American Chemical Society; Miami, FL, USA (28 Apr 1985).

The swelling induced by contracting coal with organic solvents has been investigated intensively in recent years; and several convenient methods using both liquids and saturated vapors have been developed for mesuring coal swelling properties. The liquid phase swelling behavior is particularly interesting because it is a reasonable measure of a solvent's ability to penetrate the coal matrix. Previously, investigators of this phenomenon have utilized some variation of the test tube technique developed by Dryden. In this method, the initial height of a dry coal bed, h/sub i/ is compared to the final swollen height, h/sub f/, after equilibration with solvent. These values are used to compute the equilibrium swelling ratio, Q = /sup h/f/h/sub i/, for each solvent. However, the accuracy of this method is not satisfactory, particularly at lower ($Q < 1.3$) and the higher ($Q > 3.0$) swelling ratios; and it is also quite difficult to investigate dynamic swelling behavior. Moreover, the Q-value reflects not only interactions between solvent and coal, but is also grossly affected by complicated elastic restoring forces in the coal network due to covalent bond cross-linking, hydrogen bonding, or $\pi$-$\pi$ interactions between condensed aromatics. On the other hand, initial swelling rates may isolate interactions between solvent and coal by minimizing the involvement of such complicated restoring forces. On the basis of these considerations, we have developed a new method for the dynamic measurement of liquid phase solvent swelling phenomena which is 100 times more accurate than conventional methods. We have used this technique to determine Q-values and initial swelling rates for Illinois No. 6 Coal with a variety of solvents. Here we present our initial experimental results and compare these findings with those obtained using conventional methods. 4 refs., 4 figs., 3 tabs.

45974 **Correlations for Estimating Critical Constants, Acentric Factor, and Dipole Moment for Undefined Coal-Fluid Fractions.** Watanasiri, S.; Owens, V.H.; Starling, K.E. (School of Chemical Engineering and Materials Science, University of Oklahoma, Norman, Oklahoma). *Industrial and Engineering Chemistry Process Design and Development;* **24**: No. 2, 294-296(Apr 1985).

Correlations have been developed to estimate critical constants, acentric factor, and dipole moment of model coal compounds and other hydrocarbons and their derivatives. The correlations express the characterization parameters as functions of normal boiling point, specific gravity, and molecular weight, which are the inspection data normally obtained for undefined petroleum and coal fluids. Currently available correlations are applicable only to petroleum and nonpolar coal-fluid fractions. The present correlations extend the range of application to polar and associating fluids.

45975 (BG-Trans—07131) **Characterization of coals and cokes by transmission electron microscopy.** Rouzaud, J.N.; Bensaid, F.; Oberlin, A. Translated from *Entropie ;* No. 113-114, 33-42(1983). 31p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85902084.

A series of 50 coals of varied ranks, as well as cokes obtained from their pyrolysis at 1000°C were studied by transmission electron microscopy. The aromatic units may be directly pictured. They are simular for all coals and cokes (size less than 10 A). The visualization of these units mutual orientation (microtexture) enables one to characterize such materials. Linked with elementary analysis, microtextural analysis permits one to explain their physicochemical properties. 6 refs., 19 figs.

**45976 (CE-Trans—8010) Coal analysis using thermogravimetric techniques.** Ghetti, P. Translated from *Rivista dei Combustibili ;* 34: No. 9-12, 403-409(Sep-Dec 1980). 13p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85901973.

In this paper a description is given of the standard methods for determining the moisture, volatile matter, fixed carbon and ash contents in coal. The results are also given of an investigation aimed at developing a method for the proximate analysis of coal using thermogravimetric techniques. The results obtained show that a thermobalance can be advantageously used for this type of analysis, compared with the traditional methods. Finally, some comments are expressed on the nature of volatile matter and its correct determination. 9 refs., 7 figs., 3 tabs.

## 0108 Waste Management

*REFER ALSO TO CITATION(S) 45970, 46396, 46397, 46399, 46905, 47137, 47211, 47244*

**45977 (DOE/MC/19392—1826) Performance and economic analysis of alternative treatment options for gasification wastewaters.** Wong-Chong, G.M.; Maruhnich, E.D.; Bratina, J.E. (Environmental Research and Technology, Inc., Pittsburgh, PA (USA)). Aug 1985. Contract AC21-82MC19392. 114p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE85013678.

This study is an attempt to use the existing biological treatability data base to prepare a preliminary assessment of commercial viability, both performance and costs, of several wastewater treatment system alternatives. To meet this objective it was necessary to review and assess the existing data to determine which sets of researchers studies provided quality data for the purpose of designing a full scale treatment system. Following this design basis analysis, preliminary capital and operating cost estimates were prepared for each unit operation and each integrated treatment system. 18 figs., 10 tabs.

**45978 (DOE/MC/20110—1895) Ceramic fabric material testing.** Chang, R.; Lips, H. (Acurex Corp., Mountain View, CA (USA). Energy and Environmental Div.). Jun 1985. Contract AC21-83MC20110. 226p. NTIS, PC A11/MF A01; 1; GPO Dep. File Number DE85013684.

Filter media suitable for use at temperatures greater than 550°F, employing ceramic fibers in their construction, have been under development for several years. These filter media are intended for application in advanced energy processes such as pressurized fluidized bed combustion and gasification as well as many diverse industrial processes with temperatures ranging from 600 to 1600°F. Present techniques for evaluating ceramic filter performance involve testing in subpilot and pilot-scale facilities which are both time-consuming and expensive. In addition, no standards yet exist for ensuring that the ceramic fabrics supplied for filter use conform to specifications for uniform quality. The objective of this program was to establish rapid test methods that can be used to quantitatively assess ceramic fabrics to be used as hot gas cleaning filters. Key ceramic fabric properties were first established from a consideration of field data and basic mechanisms that affect filter performance. Test methods were then developed for measuring these fabric properties. The usefulness of each test method for measuring ceramic fabric properties was evaluated by testing six different ceramic fabrics under four different conditions of temperature exposure. The testing of ceramic fabrics using different methods provided insight into how ceramic fabrics respond to temperature and external stresses and what fabric properties may be expected to affect filter performance. A list of the most useful bench-scale tests and the proper test sequence required was then established. 17 refs., 56 figs., 36 tabs.

**45979 (DOE/METC—85/6018-Vol.1, pp 6-10) Progress through cooperation: Brandon Woods Energy Business Park.** Parks, D.W. (Baltimore Gas and Electric Co., MD). May 1985. NTIS, PC A21/MF A01. File Number DE85008620. (CONF-850304—Vol.1).

From 7. international symposium on ash utilization; Orlando, FL, USA (4 Mar 1985).

When Baltimore Gas and Electric Company was faced with the problem of managing their fly ash in 1980, a property was purchased on which they planned to dispose of the coal ash. The problems they met with from community members and how they went about the task of educating the public about fly ash disposal and enlarging their plans to include an industrial park are described. Joint cooperation with regulatory bodies, political bodies, the community, and other utilities is stressed.

**45980 (DOE/METC—85/6018-Vol.1, pp 11-18) Existing high volume ash demonstration projects in the United States.** Bahor, M.P.; Patelunas, G.M. (GAI Consultants, Inc., Monroeville, PA). May 1985. NTIS, PC A21/MF A01. File Number DE85008620. (CONF-850304—Vol.1).

From 7. international symposium on ash utilization; Orlando, FL, USA (4 Mar 1985).

As part of the ERPI High Volume Ash Utilization Program, existing demonstration projects throughout the US and Canada are being documented. Data is being acquired as to the type of application, design procedure or philosophy, construction procedures and performance and environmental data. The majority of these projects are full-scale applications for which fly ash was an economical alternative to standard methods and materials. These projects include: Structural and Site Fills, Embankments, Backfills, Roadway Base Courses, Subgrade Stabilizations, Soil Amendments and Grouts. Over 200 projects have been identified that used ash in high-volume applications. More than 100 of these projects utilized 1000 or more tons of fly ash. These projects demonstrate that fly ash is a technically and economically feasible alternative to commonly used materials in many areas of the country. 5 tables.

**45981 (DOE/METC—85/6018-Vol.1, pp 19-26) Ash management: a total concept.** Marcuz, L.A. (Ash Management Systems, Inc., Houston, TX). May 1985. NTIS, PC A21/MF A01. File Number DE85008620. (CONF-850304—Vol.1).

From 7. international symposium on ash utilization; Orlando, FL, USA (4 Mar 1985).

The coordination of waste disposal and the marketing of the by-products of coal combustion are discussed based on the twenty-five years of experience of the author with the use and sale of flyash and bottom ash.

**45982 (DOE/METC—85/6018-Vol.1, pp 27-29) Use of fly ash in articulated concrete mattress for bank stabilization on the Mississippi River.** Carpenter, J.W. Jr.; Hall, D.J. (Army Corps of Engineers, Vicksburg, MS). May 1985. NTIS, PC A21/MF A01. File Number DE85008620. (CONF-850304—Vol.1).

From 7. international symposium on ash utilization; Orlando, FL, USA (4 Mar 1985).

Bank stabilization and flood control in the lower Mississippi River Valley has been an ongoing struggle since the early settlers arrived in the valley. In the late 1800's revetment mattresses made of native willow trees were developed and satisfactorily held the banks when completely submerged. Deterioration of the woven mats in the area between low and high river stages caused the Corps of Engineers to experiment with concrete mats. With the 1000 miles of river to overlook, any small improvement in the process of stabilization results in a large savings. The incorporation of flyash into the concrete, the advantages incurred in the casting of the concrete mats and the materials handling of the mats, and the savings resulting are described.

**45983 (DOE/METC—85/6018-Vol.1, pp 30-43) Pressure grouting of concrete highways and airports utilizing flyash/cement grouts.** Del Val, J.; Martin, R.G. (Del Val, Inc., Fort Worth, TX). May 1985. NTIS, PC A21/MF A01. File Number DE85008620. (CONF-850304—Vol.1).

From 7. international symposium on ash utilization; Orlando, FL, USA (4 Mar 1985).

This paper presents an overview of current practice in concrete pavement jacking and grout subsealing of concrete pavements. The discussion covers: (1) material and the physical properties needed for same; (2) equipment requirements; (3) methods and the current state of the art. The appendix contains an in depth dis-

cussion of pavement jacking and subsealing with flyash/cement grouts.

45984 (DOE/METC—85/6018-Vol.1, pp 44-49) **Pipe bedding with class C fly ash grout.** Mings, M.L. (Walter N. Handy Co., Inc., Springfield, MO). May 1985. NTIS, PC A21/MF A01. File Number DE85008620. (CONF-850304—Vol.1).

From 7. international symposium on ash utilization; Orlando, FL, USA (4 Mar 1985).

The burning of sub-bituminous coal, from Wyoming's Powder River Basin, at electric generating stations has created a relatively new type of fly ash. This type of fly ash, designated by American Society for Testing and Materials as Class C, possesses self-cementing properties in addition to being pozzolanic. For some applications, the self-cementing properties of Class C fly ash provides enough strength gain to utilize the ash without the addition of portland cement or lime. This paper describes one such application where a Class C fly ash was utilized in a grout mix to bed pipe on a major aquaduct project in Southern Oklahoma. 5 tables.

45985 (DOE/METC—85/6018-Vol.1, pp 50-56) **Use of fly ash-cement grout to rehab a century-old railroad tunnel.** Majko, R.M. (American Fly Ash Co., Des Plaines, IL). May 1985. NTIS, PC A21/MF A01. File Number DE85008620. (CONF-850304—Vol.1).

From 7. international symposium on ash utilization; Orlando, FL, USA (4 Mar 1985).

The 100 year old Bergen Tunnel in Hoboken, NJ is being rehabilitated with a grout comprised of 4 parts Class F fly ash and 1 part Portland cement (by volume). This 4219 ft. long by 27 ft. wide by 35 ft. high twin tunnel is used by electric commuter trains. Complete grouting of the voids will require an excess of 5000 tons of fly ash to fill the voids behind the old (1887) stone and brick tunnel and the newer (1908) cast-in-place concrete tunnel. The grout fills the voids to prevent water seepage that was causing deterioration of the in-place electrical system and causing stalactite formation. The grout is pumped through a series of pre-drilled holes through the inner tunnel wall. The fly ash-cement grout provides better pumpability, better penetration, and void-filling than the alternate cement-sand grout. The project engineer is primarily concerned with permeabilities which range from 0.2-1.2 x $10^{-6}$ for the 1:1 grout to 2.7-5.0 x $10^{-6}$ cm/sec for the 5:1 grout. The project is expected to be completed by the summer of 1985.

45986 (DOE/METC—85/6018-Vol.1, pp 57-66) **Cement fly ash mixes for pavements.** Barenberg, E.J. (Univ. of Illinois, Urbana). May 1985. NTIS, PC A21/MF A01. File Number DE85008620. (CONF-850304—Vol.1).

From 7. international symposium on ash utilization; Orlando, FL, USA (4 Mar 1985).

Since the early 1960's portland cement has been used in varying amounts as an accelerator for some lime-fly ash-aggregate mixes. As the amounts of cement gradually increased it has become apparent that in many instances there would be economic as well as technical advantages in eliminating the lime and making mixes of cement and fly ash with or without aggregates. This paper presents data on some engineering properties of cement-fly ash mixes for use in pavements. In some instances comparisons are made between the properties of lime fly ash and cement fly ash mixes. Both roller compacted and plastic cement-fly ash mixes are examined. Possible savings in the amount of cement needed to produce mixes with a specified strength are provided. The paper concludes that the cement-fly ash mixes have the potential to provide high quality paving materials but each mix must be verified by laboratory testing using the specific components proposed for use in construction. 9 figures, 7 tables.

45987 (DOE/METC—85/6018-Vol.1, pp 67-69) **Effective and low-cost erosion control of inactive coal storage piles.** Simmons, D.E.; Degenhardt, G.M.; Jones, R.W. (Gulf States Utility Co., Westlake, LA). May 1985. NTIS, PC A21/MF A01. File Number DE85008620. (CONF-850304—Vol.1).

From 7. international symposium on ash utilization; Orlando, FL, USA (4 Mar 1985).

Erosion of coal storage pile banks by wind and rain cost utilities thousands of dollars each year in lost fuel, coal pile maintenance, and environmental equipment. The main problem at Nelson Unit 6 was loss due to frequent and heavy rains. Average yearly rainfall in this part of Louisiana is 56 inches. There is a definite rainy season in the winter months and the long summer brings heavy tropical-type downpours. This paper outlines the efforts to control erosion by conventional methods, chemical treatment, and finally the application of aerated fly ash to the coal pile slopes.

45988 (DOE/METC—85/6018-Vol.1, pp 70-77) **Belle River: an update on ash utilization.** Schivley, W.W. (Gilbert/Commonwealth Inc. of Michigan, Jackson). May 1985. NTIS, PC A21/MF A01. File Number DE85008620. (CONF-850304—Vol.1).

From 7. international symposium on ash utilization; Orlando, FL, USA (4 Mar 1985).

Over the last 10-year period The Detroit Edison Company has undertaken an ambitious program of ash utilization at the Belle River/St. Clair power generation complex. This program has been comprehensive and has addressed numerous solutions to ash utilization while also meeting the ancillary challenges associated with the handling and disposal of fly ash. Substantial additions and improvements to the early efforts have been accomplished. The structural fill applications have tripled, and an extensive 5-year study of eastern and western ash revegetation has also been completed. This presentation explores these two ash utilization efforts, describing in detail all technical aspects while exploring the political opportunities studies of this nature afford electric utilities.

45989 (DOE/METC—85/6018-Vol.1, pp 78-93) **Abandoned strip mine reclamation using power plant ash from western coal.** Zimmerman, L.G. (Midwest Fly Ash and Materials, Inc., Sioux City, IA). May 1985. NTIS, PC A21/MF A01. File Number DE85008620. (CONF-850304—Vol.1).

From 7. international symposium on ash utilization; Orlando, FL, USA (4 Mar 1985).

Abandoned coal strip mines in southeastern Iowa are unsightly and environmentally damaging to the quality of surface water in the region. They also pose safety hazards due to their close proximity to roadways and deep pools of contaminated water that invite careless swimmers. Midwest Fly Ash and Materials, Inc. has contracted with Iowa Southern Utilities Company to reclaim some of this privately owned land using western coal fly ash in the process. Conversion of the lunar landscape of the abandoned mines to rolling, vegetated hillsides is occurring simultaneously with the disposal of power plant residues. Feasibility of this process from a research study and field methods for transportation and reclamation processes are presented.

45990 (DOE/METC—85/6018-Vol.1, pp 94-105) **Fly ash/soil mixtures plus additives for field corn production.** Keefer, R.F.; Singh, R.N. (West Virginia Univ., Morgantown). May 1985. NTIS, PC A21/MF A01. File Number DE85008620. (CONF-850304—Vol.1).

From 7. international symposium on ash utilization; Orlando, FL, USA (4 Mar 1985).

Fly ash was utilized as a base for construction of research field plots on which corn was grown. On top of the base, a covering was constructed of 35 cm of fly ash mixed with 25 cm of soil (58% fly ash:42% soil) or 48 cm of fly ash mixed with 13 cm of soil (79% fly ash:21% soil). Individual plots received additives of cow manure at 0, 60, or 120 metric tons/hectare (T/ha), sewage sludge at 0, 60, or 120 T/ha, or chicken manure at 0, 25, or 50 T/ha in a factorial combination. Corn grain and fodder yields for the first year of a three year study were calculated. Corn leaves at one meter high stage and at tasseling and mature corn grain were analyzed for N, P, K, Ca, Mg, Cu, Fe, Mn, Zn, and B. Corn grain and fodder grown in the field on a growth medium consisting of large amounts of fly ash (58% of the mix) yielded more in the first year than adjacent farmer-managed control plots. The greater corn yield from fly ash/soil mixtures probably resulted from improved water holding capacity of the mix. Chemical plant analyses showed improved nutrition of the corn grown on the fly ash mixes, except excessive amounts of boron were present in corn leaves when 79% of the growth medium consisted of fly ash. Also, corn grain yield was

reduced on the 79% fly ash:21% soil medium, but boron was not translocated into the grain. Nutrition of the corn plants was likewise improved by addition of organic amendments. Data from the first year have shown that field corn can be successfully grown on a mixture of 58% fly ash:42% soil. Higher proportions of fly ash in the growth medium can be used; however, production was decreased probably due to toxic levels of boron. 27 references, 5 tables.

45991 (DOE/METC—85/6018-Vol.1, pp 106-127) **Establishment of vegetation on mixtures of bottom ash and fly ash.** Macak, J.J. III; Knight, M.J. (Commonwealth Edison Co., Chicago, IL). May 1985. NTIS, PC A21/MF A01. File Number DE85008620. (CONF-850304—Vol.1).

From 7. international symposium on ash utilization; Orlando, FL, USA (4 Mar 1985).

The cost of obtaining, transporting, and constructing soil cover layers during fly ash landfill closure represents one of the most expensive components of this activity. The simplest alternative to the use of soil cover layers at fly ash landfills would be to establish vegetation directly upon the ash itself. While soil, river dredging, straw, and a variety of other materials have been evaluated as amendments to improve the physical nature of fly ash, no efforts have been made to evaluate the efficacy of bottom ash as a fly ash amendment. Bottom ash would seem an ideal choice. It consists of much larger sized particles (75% by weight are 0.1 to 10 mm in size) than fly ash, and thus would seem suitable as the coarse-textured material needed to amend fly ash. Large amounts of bottom ash are available at the source of fly ash generation, at no cost. While bottom ash cannot contribute appreciable amounts of plant nutrients to fly ash, neither will it add appreciably to the amounts of potentially toxic trace elements present in fly ash. Therefore, the principal objective of this research was to evaluate the effects of various combinations of bottom ash and fly ash on vegetation establishment and plant community longevity. To provide the necessary organic material and plant nutrients, sewage sludge and chemical fertilizers were employed. 30 references, 12 figures, 5 tables.

45992 (DOE/METC—85/6018-Vol.1, pp 128-142) **Coal ash use as an economical cover at sanitary landfills.** Glick, H.B. (New England Power Service Co., Westborough, MA). May 1985. NTIS, PC A21/MF A01. File Number DE85008620. (CONF-850304—Vol.1).

From 7. international symposium on ash utilization; Orlando, FL, USA (4 Mar 1985).

The fact remains coal ash usage on sanitary landfills in Rhode Island and Massachusetts has been shown, in case after case, to be an economical and reliable cover material. However, do not be lulled into thinking ash is a miracle aggregate or the answer for all sanitary landfill problems; it is neither. Ash has wet weather limitations, and stringent controls must be exercised in handling the material. Placed properly, ash can be utilized beneficially and very satisfactory results obtained.

45993 (DOE/METC—85/6018-Vol.1, pp 143-146) **Illinois highways in the year one, A.F.** Berry, D.H. (Illinois Dept. of Transportation, Springfield). May 1985. NTIS, PC A21/MF A01. File Number DE85008620. (CONF-850304—Vol.1).

From 7. international symposium on ash utilization; Orlando, FL, USA (4 Mar 1985).

Studies undertaken by the Illinois Department of Transportation on the feasibility of using flyash in Portland cement stabilized subbase and Portland cement concrete pavement are described. During 1984, the opportunity arose to construct contiguous sections of standard and flyash pavements. Tables list field test data for comparison of subbase and pavement with and without flyash, but future ash usage is tied closely to the performance of the pavement system through the 1984-1985 winter season.

45994 (DOE/METC—85/6018-Vol.1, pp 147-150) **New marketing concepts for utility ash.** Kinder, D.L.; Benza, S.T. (KBK Enterprises, Inc., Charleston, WV). May 1985. NTIS, PC A21/MF A01. File Number DE85008620. (CONF-850304—Vol.1).

From 7. international symposium on ash utilization; Orlando, FL, USA (4 Mar 1985).

New marketing concepts which will permit the utilization of large tonnages of power plant ash are discussed in detail. The production of ash produced by large coal fired plants has reached monumental proportions and requires mass tonnage applications to make substantial reduction in the amount of ash that must be disposed of by the Utility Industry. This paper identifies the requirements for a particular marketing program that provides high volume uses such as structural fills, embankments, backfills and lightweight aggregate.

45995 (DOE/METC—85/6018-Vol.1, pp 151-160) **Forecasted ash utilization in commercial markets: an econometric analysis.** Parks, D.; Boyd, R. Jr.; Marchetti, J. (Baltimore Gas and Electric Co., MD). May 1985. NTIS, PC A21/MF A01. File Number DE85008620. (CONF-850304—Vol.1).

From 7. international symposium on ash utilization; Orlando, FL, USA (4 Mar 1985).

The purpose of this paper is to report on an econometric modelling technique which has been used to forecast coal combustion by-product utilization in commercial markets. The technique, in modified form, has been used successfully with other by-products; however, this is the first time it has been applied to coal combustion by-products. The merits of econometric forecasting are examined in this paper, the reasonableness of the forecasts are tested using actual data, and updated models for the cement and concrete sectors are developed. 3 references, 3 figures, 5 tables.

45996 (DOE/METC—85/6018-Vol.1, pp 161-165) **Regional marketing strategy for expanded ash utilization.** Kraft, D.C.; Larson, J.D.; Madl, P.J. (Managing Technology, Inc., Lawrence, KS). May 1985. NTIS, PC A21/MF A01. File Number DE85008620. (CONF-850304—Vol.1).

From 7. international symposium on ash utilization; Orlando, FL, USA (4 Mar 1985).

One of the continuing major impediments to further expansion of ash utilization is a lack of knowledge on the part of the potential user community of the many ash applications. Because of the variability of the ash product and the particular needs associated with regional applications, the use of a nationally focused marketing approach for ash utilization will be limited in its effectiveness. The paper summarizes a regionally focused marketing program developed through the joint cooperation of Kansas Power and Light Company, its ash distributors and Managing Technology, Inc. designed to increase ash utilization in a number of application areas. The details of the program's approach are provided which included development and distribution of ten (10) ash use fact sheets. These fact sheets included examples of ash use specific to the Kansas geographic area. The means of distributing these fact sheets and providing follow up information are also covered.

45997 (DOE/METC—85/6018-Vol.1, pp 166-183) **New opportunities for fly ash as a usable resource.** Minnick, L.J. May 1985. NTIS, PC A21/MF A01. File Number DE85008620. (CONF-850304—Vol.1).

From 7. international symposium on ash utilization; Orlando, FL, USA (4 Mar 1985).

Fly ash in combination with other inorganic by-products is providing markets for construction type applications. The sources of these secondary residuals are generated from technologies such as LIMB (limestone injection multi-stage boilers), dry scrubbing, post flame injection, etc. Other residuals include portland cement and limekiln dust, and ash from fluidized bed combustion of coal. This paper describes activities of an ASTM resource recovery committee which deals with construction and other secondary applications of recovered process waste. Guidelines and standard practices have been prepared relating to fly ash. Experiences of commercial applications are presented including methods of preconditioning, handling, and production of the blended products. A brief review of process costs is also presented. 15 references, 10 figures.

45998 (DOE/METC—85/6018-Vol.1, pp 184-212) **Systematic approach to ash market investigations.** Komai, R.Y.; Daley, J.R.; Kurgan, G.J. (Electric Power Research Institute, Palo Alto, CA). May 1985. NTIS, PC A21/MF A01. File Number DE85008620. (CONF-850304—Vol.1).

From 7. international symposium on ash utilization; Orlando, FL, USA (4 Mar 1985).

A primary objective of the Electric Power Research Institute's Coal Combustion By-Products Utilization Manual was to develop a systematic approach to ash market investigations which would be useful to newcomers to ash utilization. This approach is the result of interviews with utility personnel and ash marketers, responses to a questionnaire and case study interviews. The six primary steps to the suggested procedure are: (1) By-Product Characterization; (2) Option Identification; (3) Marketing Mix; (4) Operations Plan; (5) Cost Determination; and (6) Option Selection/ Quantity Distribution. This procedure is demonstrated for Long Island Lighting Company's Port Jefferson Station, since LILCO was evaluating available disposal/utilization options if they were to convert the two 190 MW units from oil to coal. It is noted that no actual decision has been made to convert at this date. The demonstrated example shows that utilization could be a feasible alternative at the Port Jefferson Station. Feasible ash markets were found to include the following: fly ash as a partial replacement for portland cement; fly ash as a bituminous mineral filler; bottom ash as a bituminous aggregate and bottom ash as an ice control material. 16 references, 9 figures, 6 tables.

45999 (DOE/METC—85/6018-Vol.1, pp 213-215) **Fly ash quality assurance and the Corps of Engineers pozzolan quality management system.** Faber, J.H.; Lamond, J.F. (Faber Associates, Shepherdstown, WV). May 1985. NTIS, PC A21/MF A01. File Number DE85008620. (CONF-850304—Vol.1).

From 7. international symposium on ash utilization; Orlando, FL, USA (4 Mar 1985).

For over 50 years the Corps of Engineers have used class N natural pozzolans in concretes. After WWII pretested flyash from eastern bituminous coals were specified for use. When subbituminous coal and lignite from the western US began to be used, a third pozzolan was produced which was also suitable for concrete. To simplify purchasing procedures the Corps of Engineers has adopted a new policy which allows for source prequalification. The procedure for obtaining qualification as a source of pozzolan is outlined.

46000 (DOE/METC—85/6018-Vol.1, pp 216-221) **Cenospheres: fly-ash disposal or hollow microspheres utilization.** Dower, J.E. (Filtec Ltd., Frodsham, England). May 1985. NTIS, PC A21/MF A01. File Number DE85008620. (CONF-850304—Vol.1).

From 7. international symposium on ash utilization; Orlando, FL, USA (4 Mar 1985).

Since the last International Ash Utilization symposium in Reno in 1982 there has been a substantial advance in the application of ash products into sophisticated added value applications, particularly for cenospheres. This paper looks at some of the opportunities for collaboration between the producers of these materials and the entrepreneurs whose skills are needed to effectively convert fly-ash into hollow microspheres.

46001 (DOE/METC—85/6018-Vol.1, pp 222-239) **Laboratory evaluations of stabilized flue gas desulfurization sludge (Scrubber sludge) and aggregate mixtures.** Anderson, M.; Sharpe, G.W.; Allen, D.L.; Southgate, H.F.; Deen, R.C. (Univ. of Kentucky, Lexington). May 1985. NTIS, PC A21/ MF A01. File Number DE85008620. (CONF-850304—Vol.1).

From 7. international symposium on ash utilization; Orlando, FL, USA (4 Mar 1985).

The Kentucky Transportation Research Program studied the use of flue gas desulfurization sludge (scrubber sludge) for potential application as a highway subbase and/or embankment material. Scrubber sludge is a waste product formed when fly ash (and other residue) is combined with a lime dust slurry filter cake and stabilized with quicklime (calcium oxide). Samples of stockpiled sludge and dry sludge components were obtained from the Robert Reid Station in Sebree, Kentucky. Dry sludge components (fly ash, filter cake, and quicklime) were used to prepare sludge samples in the laboratory, allowing a higher degree of quality control for comparison purposes. Mixtures for testing included scrubber sludge, scrubber sludge with pond ash (bottom ash), and scrubber sludge with dense graded limetone aggregate (DGA). A mixture of 20% scrubber sludge and 80% pond ash was determined to be the optimum design mix. That mixture showed significant strength gain with curing and had a static-chord modulus of elasticity approximately 118 times the compressive strength. Strength and modulus tests indicated that mixtures of scrubber sludge and pond ash were superior to mixtures of scrubber sludge and DGA. An economic study showed that scrubber sludge with pond ash can be used economically as a highway subbase material, especially on low-fatigue roads, by partially replacing more expensive pavement layers. Triaxial tests and computer simulations indicated that scrubber sludge could be used as an embankment material in some applications. However, this would be economical only if suitable fill material was not available at or near the fill site. 11 referenc.., 12 figures, 8 tables.

46002 (DOE/METC—85/6018-Vol.1, pp 240-245) **Insights into fly-ash by means of a cooperative research program.** Kruger, R.A. (Council for Scientific and Industrial Research, Pretoria, South Africa). May 1985. NTIS, PC A21/MF A01. File Number DE85008620. (CONF-850304—Vol.1).

From 7. international symposium on ash utilization; Orlando, FL, USA (4 Mar 1985).

The energy required for industrial expansion of South Africa will be met from the country's vast coal reserves. The amount of ash generated is expected to exceed 30 million tons by 1992. In view of the shortage of suitable disposal sites and the environmental problems concomitant with the accumulation of the enormous quantities of ash, it was decided to launch a cooperative research programme to investigate the various possibilities of making the maximum use of the resource potential of fly-ash. There are a number of potential uses for fly-ash e.g. as a pozzolan in concretes, as an additive in brickmaking, as a source of alumina and other minerals, etc. This paper describes the devised cooperative research programme and presents some of the results obtained to date.

46003 (DOE/METC—85/6018-Vol.1, pp 246-263) **Corrosion of metals in coal ash: a field study.** Headon, A.C.; Chan, H.T. (Ontario Hydro, Toronto). May 1985. NTIS, PC A21/MF A01. File Number DE85008620. (CONF-850304—Vol.1).

From 7. international symposium on ash utilization; Orlando, FL, USA (4 Mar 1985).

This paper reports a two-year field study of the corrosion of metals in fly ash and bottom ash. Metal specimens were embedded in the test media, compacted in containers installed in an open field. The corrosion rates of the metals in the ash were measured after one- and two-year periods and were compared with the corrosion of the same metals in a Class A backfill. The environmental factors affecting the metal corrosion in the ash were also studied. The practical implication of the data on the use of coal ash as backfills is discussed. 8 references, 5 figures, 7 tables.

46004 (DOE/METC—85/6018-Vol.1, pp 264-272) **Ash utilization enhanced by ultrasound.** Morton, W.E.; Wallis, J.; Fairbanks, H. (Heritage Industries, Inc., Bridgeport, WV). May 1985. NTIS, PC A21/MF A01. File Number DE85008620. (CONF-850304—Vol.1).

From 7. international symposium on ash utilization; Orlando, FL, USA (4 Mar 1985).

This paper discusses the use of an ultrasonic processing unit which has many applications for enhancing the utilization of ash. The unit consists of an ultrasonically vibrated inclined metal trough. The dimensions of the trough are determined by the ultrasonic frequency used, the type of slurry, and the capacity desired. The ash is mixed with water to form a slurry which flows over the surface of the ultrasonically vibrated trough. Deagglomeration of the particles takes place along with a cleaning action on the surfaces of the particles. This cleaning action breaks the surface tension, thereby producing: (1) better settling, (2) better particle compaction, and (3) better water drainage. Making use of these above mentioned factors, the following processes were investigated: (1) recovery of minerals from ash making use of magnetic separation, (2) recovery of minerals from ash making use of specific gravity methods, and (3) fly ash compaction and water drainage studies. 11 references.

46005 (DOE/METC—85/6018-Vol.1, pp 273-279) **Improving the early strength of fly ash cement and studying the storage properties of fly ash granule.** Ying, P. (Institute of Hubei Province Building Material Research and Design, Wuchang, China). May 1985. NTIS, PC A21/MF A01. File Number DE85008620. (CONF-850304—Vol.1).

From 7. international symposium on ash utilization; Orlando, FL, USA (4 Mar 1985).

In a previous study it was shown that fly ash bonded with an admixture and granulated was easier to store, transport, and use in cement or light aggregate. This study describes the mechanical properties of the cement formed using this granule and portland clinker. The mechanism of strength increase of the fly ash cement with time is discussed. The change of the mechanical properties of the fly ash granules during storage, the adsorption of moisture, and a curing process in water are also investigated. 9 references, 5 figures, 6 tables.

46006 (DOE/METC—85/6018-Vol.1, pp 280-288) **FGD sludge disposal consumes over eight million tons of fly ash yearly.** Smith, C.L. (Conversion Systems, Inc., Horsham, PA). May 1985. NTIS, PC A21/MF A01. File Number DE85008620. (CONF-850304—Vol.1).

From 7. international symposium on ash utilization; Orlando, FL, USA (4 Mar 1985).

Wet scrubbing with limestone or lime is the best available technology for flue gas desulfurization. The waste sludge produced new amounts to several million gallons per year. The Poz-O-Tec process described herein disposes of this sludge in an environmentally safe manner. The sludge is mixed with fly ash and lime to produce a cementitious product suitable for ground disposal, subbase for road construction, lightweight aggregate, or similar construction purposes.

46007 (DOE/METC—85/6018-Vol.1, pp 289-303) **Scrubber base: an alternative to concrete, limestone and asphalt mixes.** Gallagher, R.E. (Houston Lighting & Power Co., TX). May 1985. NTIS, PC A21/MF A01. File Number DE85008620. (CONF-850304—Vol.1).

From 7. international symposium on ash utilization; Orlando, FL, USA (4 Mar 1985).

The main purpose of this paper is to evaluate scrubber sludge material as a marketable construction material. The report is limited to the discussion of the production, application and evaluation of scrubber sludge as a marketable material. Its pricing, application and performance are compared to limestone, asphalt mixes and 3000 psi concrete. The other by-products of the coal plant are not discussed, except for the part they play in marketing the scrubber sludge. 6 tables.

46008 (DOE/METC—85/6018-Vol.1, pp 304-316) **Beneficiated products from fly ash: market research.** Wilson, H.S.; Burns, J.S. (Energy, Mines and Resources Canada, Ottawa, Ontario). May 1985. NTIS, PC A21/MF A01. File Number DE85008620. (CONF-850304—Vol.1).

From 7. international symposium on ash utilization; Orlando, FL, USA (4 Mar 1985).

Research done in recent years shows that fly ash can be separated into size fractions and components, thus making it a valuable mineral resource. This study examined the state-of-the-art on the beneficiation of fly ash to recover cenospheres, magnetic iron compounds, and carbon. Methods of beneficiation, applications for products and possible market prices are discussed. 41 references.

46009 (DOE/METC—85/6018-Vol.1, pp 317-324) **Magnetic recovery of ferromagnetic values from fly ash.** Bronkala, W.J. (Midland Standard, Inc., Cleveland, OH). May 1985. NTIS, PC A21/MF A01. File Number DE85008620. (CONF-850304—Vol.1).

From 7. international symposium on ash utilization; Orlando, FL, USA (4 Mar 1985).

This discussion is directed to the use of relatively low intensity magnetic separators to remove the ferromagnetic constituents of the ash. Magnetic treatment to date has been considered for the production of: (1) high density product for use as a media in heavy media separation of coal; (2) a high density product for potential use in drilling muds; (3) a clean fly ash, free of ferrous oxidizing materials that causes stain when used in cement blocks; (4) an upgraded product for use in producing anti-skid lightweight aggregate; (5) a controlled additive for use as a source of $Al_2O_3$ in cement production; and (6) concentration of high value metals products contained in the fly ash. Both wet and dry magnetic separation of fly ash is described.

46010 (DOE/METC—85/6018-Vol.1, pp 325-328) **Mobile screening systems.** Kieran, E.A. (Powerscreen of America, Louisville, KY). May 1985. NTIS, PC A21/MF A01. File Number DE85008620. (CONF-850304—Vol.1).

From 7. international symposium on ash utilization; Orlando, FL, USA (4 Mar 1985).

The advantages are discussed for using the Powerscreen MKII, a modular, mobile screen, to recover granular materials from ash dumps to use as aggregates, in the production of concrete blocks, and as subbase material for road construction. Operating costs are also cited.

46011 (DOE/METC—85/6018-Vol.1, pp 329-341) **Pozzo-crete.** Collins, W. (National Minerals Corp., Fargo, ND). May 1985. NTIS, PC A21/MF A01. File Number DE85008620. (CONF-850304—Vol.1).

From 7. international symposium on ash utilization; Orlando, FL, USA (4 Mar 1985).

Results are given of the studies done by the National Mineral Corporation to determine if high cement replacements with fly ash would gain acceptable strengths and be able to withstand the durability tests generally associated with normal concrete. Trial batches and products that are now marketed are described, and their mechanical properties and performance in concretes are summarized. Pozzo-crete is recommended for use in pavements, interior and exterior slabs, drainage ditches, and footings. 6 tables.

46012 (DOE/METC—85/6018-Vol.1, pp 342-346) **Crack control of pozzolanic bases.** Traylor, M.L. Jr.; Lippert, D.L. (Illinois dept. of Transportation, Springfield). May 1985. NTIS, PC A21/MF A01. File Number DE85008620. (CONF-850304—Vol.1).

From 7. international symposium on ash utilization; Orlando, FL, USA (4 Mar 1985).

The Illinois Department of Transportation set up a field test to determine whether the location and shape of cracks caused by shrinkage of the fly ash aggregate subbase could be controlled by sawing joints at periodic intervals and sealing these cracks as is done with concretes. The experimental design was planned with 15, 25, and 40 foot spacings. To date all three joint spacings have proved successful; however, since the project has been in place only two years, the Department hesitates to conclude that the 40 foot spacing is as effective as the shorter spacings.

46013 (DOE/METC—85/6018-Vol.1, pp 347-360) **New method for the measurement of workability of high pulverized fuel ash concrete.** Cabrera, J.G.; Lee, R.E. (Univ. of Leeds, England). May 1985. NTIS, PC A21/MF A01. File Number DE85008620. (CONF-850304—Vol.1).

From 7. international symposium on ash utilization; Orlando, FL, USA (4 Mar 1985).

The measurement of the workability of dry no-slump concrete manufactured with high content of pulverized fuel ash (pfa) is a practical problem for contractors attempting to produce uniform rollable mixes for the construction of dams and pavements. The usual method for the assessment of the water content of a high pfa-concrete mix is the Cannon method, which for experienced concrete technologists appears to give good results. The method is, however, qualitative in nature and thus susceptible to operator variability. This paper presents a new simple quantitative method which does not depend on a qualitative assessment but on a simple measurement. A detailed description of the apparatus and the procedure for its use is included. The paper also presents data comparing results obtained with the Cannon test and with this new test called the Cabrera Vibrating Slump Test. Mixes designed with the new test give strengths which are higher than the mixes designed using the Cannon test. 7 references, 4 figures, 3 tables.

46014 (DOE/METC—85/6018-Vol.1, pp 361-371) **Power company's experience with stabilization.** Grosz, W.E. (Basin Electric Power Cooperative, Bismarck, ND). May 1985. NTIS, PC A21/MF A01. File Number DE85008620. (CONF-850304—Vol.1).

From 7. international symposium on ash utilization; Orlando, FL, USA (4 Mar 1985).

This paper presents the chronology of testing and field applications of a highly reactive Class C fly ash produced at the Laramie River Station in Wyoming. The problems involved in using this ash for soil stabilization were mainly tied to the quick set characteristics of the ash, and therefore it was necessary to locate or develop a retarder which would be consistent as well as easy to use in the field. This paper gives test results of a field application done prior to finding a suitable retarder. It shows that the results were time dependent and that it was physically impossible to complete the application prior to hydration beginning. It then addresses lab work which led to a successful retarder and a field experimental section. Field results led to the decision to eliminate 11,000 tons of asphalt which was scheduled for a paving contract on site. In place of asphalt, roads and parking areas were stabilized with fly ash only and then a wearing surface consisting of a chip seal was applied. The paper covers work done over the period of 1981-1982 and has numerous laboratory and field data included. 10 figures.

46015 (DOE/METC—85/6018-Vol.1, pp 372-380) **Mix design of soil-flyash for canal lining.** Janardhanam, R. (Univ., of North Carolina, Charlotte). May 1985. NTIS, PC A21/MF A01. File Number DE85008620. (CONF-850304—Vol.1).

From 7. international symposium on ash utilization; Orlando, FL, USA (4 Mar 1985).

Flyash, as a major ingredient, with lime and cement are tried together with sand for canal lining. A laboratory test program and analysis of test data indicate that flyash can be advantageously used with cement, lime and soil for lining the canals. Tests for unconfined compressive strength, moisture-density relationship, durability and permeability are included in the laboratory test program. Test data are utilized in the development of a mix design procedure aimed at optimizing the admixture proportions. 6 references.

46016 (DOE/METC—85/6018-Vol.1, pp 393-401) **Lessons in using fly ash slurry.** Tansey, P.H. Jr. (Kansas City Power & Light Co., MO). May 1985. NTIS, PC A21/MF A01. File Number DE85008620. (CONF-850304—Vol.1).

From 7. international symposium on ash utilization; Orlando, FL, USA (4 Mar 1985).

This paper describes one full year's experience in using different fly ashes with or without blending with sand, aggregate or other fly ashes, with different percentages of water. It details strength gain versus time. Applications wee underground and open trench fills. Discussion includes need for anticipatory advanced testing of possible alternatives and minimizing time delay in gaining environmental clearances from Public Officials on ground water pollution or corrosive effect on cast iron water or gas pipes.

46017 (DOE/METC—85/6018-Vol.1, pp 402-417) **Solidification of fly ash with other industrial waste material.** Kuo, S.T.; Su, I.H.; Hsu, C.C.; Chen, M.P. (Taiwan Power Co., Taipei). May 1985. NTIS, PC A21/MF A01. File Number DE85008620. (CONF-850304—Vol.1).

From 7. international symposium on ash utilization; Orlando, FL, USA (4 Mar 1985).

The objective of the research was mainly concerned with the ash management from the technical and economical view points. Pulverized Fuel Ash (Fly Ash) was mixed with other wasted material, Calcium Hydroxide, from ethylene and plastic production. Through pozzolanic reaction, fly ash was reacted slowly with calcium hydroxide and became a hardened material. The experimental work studied the strength development at various curing conditions, chemical leachability of fly ash before and after being solidified, and the application case of making artificial marine reef. 12 figures, 6 tables.

46018 (DOE/METC—85/6018-Vol.1, pp 418-435) **Environmental and engineering studies of fly ash disposal in a shale quarry.** Cragg, C.; Chan, H.T. (Ontario Hydro, Toronto). May 1985. NTIS, PC A21/MF A01. File Number DE85008620. (CONF-850304—Vol.1).

From 7. international symposium on ash utilization; Orlando, FL, USA (4 Mar 1985).

This paper reports an extensively engineered and controlled fly ash landfill in a 25-acre shale quarry in Toronto, Canada. A comprehensive environmental impact study was undertaken prior to starting the landfill operation. The significantly poorer quality of shale ground water compared to fly ash leachate was instrumental in the project approval. Since the landfill started, ground water quality, surface runoff and dust have been monitored. Filling has been sequenced to minimize environmental impact. To ensure good foundation support for the future subdivision development, the density of the compared ash has been monitored regularly. The experience in this reclamation project accumulated to date is discussed. 10 figures, 5 tables.

46019 (DOE/METC—85/6018-Vol.1, pp 445-454) **Control of fugitive dust when unloading large fly ash silos.** Jeskey, A.C.; Margison, E.R. (United Conveyor Corp., Deerfield, IL). May 1985. NTIS, PC A21/MF A01. File Number DE85008620. (CONF-850304—Vol.1).

From 7. international symposium on ash utilization; Orlando, FL, USA (4 Mar 1985).

The quantity of fly ash produced by utility coal fired plants requires the use of large storage silos. Removing and conditioning the fly ash from these large silos requires high capacity unloading systems with minimum fugitive dust when loading ash into open top trucks. An environmentally acceptable fly ash unloading system must include: (1) a properly designed silo fluidizing system and discharge configuration to ensure as uniform a flow as possible; (2) ash feed devices upstream of the unloader for control of the rate of solids flow into the unloader; (3) unloading machinery capable of high throughput with minimum retention time; and (4) dust control at the unloader discharge for fly ash that escapes combining in the mixture. This paper summarizes United Conveyor Corp. design parameters for the control of fugitive dust.

46020 (DOE/METC—85/6018-Vol.1, pp 455-464) **In situ solidification/fixation of industrial wastes, a novel technique.** Smith, R.L.; DeGrood, T.J.; Musser, D.T. (ENRECO, Inc., Amarillo, TX). May 1985. NTIS, PC A21/MF A01. File Number DE85008620. (CONF-850304—Vol.1).

From 7. international symposium on ash utilization; Orlando, FL, USA (4 Mar 1985).

The disposal of industrial wastes which are liquid or sludge-like in consistency is a serious problem facing industry today. Below ground storage of liquid wastes is receiving increasing criticism as a disposal option. Existing ponds and lagoons are gradually being closed, the wastes typically removed in liquid form to a secure landfill or solidified in place. Fly ash and other mineral by-products are finding an increasing application as a solidification agent to convert the liquid waste into a solid material. This paper describes a technology for injecting dry solidification agents into the pond and converting the sludge into a material of soil-like consistency. Two case histories are described; one study involves the solidification of oil field product fluids followed by capping with soil, whereas the second study describes the solidification of a PCB waste sludge followed by removal to a secure landfill.

46021 (DOE/METC—85/6018-Vol.1, pp 473-486) **Coal ash management in Maryland.** Simek, E.M. (Environmental Resources Management, Inc., Annapolis, MD). May 1985. NTIS, PC A21/MF A01. File Number DE85008620. (CONF-850304—Vol.1).

From 7. international symposium on ash utilization; Orlando, FL, USA (4 Mar 1985).

Presently, about one million tons per year of ash are generated by power plants within Maryland. All aspects of the collection, handling, transport, and ultimate disposition of these large volumes of ash are managed by the utilities and regulated by government agencies. One State agency which has investigated many aspects of

ash management in Maryland is the Department of Natural Resources Power Plant Siting Program. Under contract to this agency, Environmental Resources Management, Inc. and others have conducted several interrelated studies over the past four years on topics ranging from groundwater impacts to ash marketing. This paper integrates the results of those studies to present an overview of coal ash management in the State. 15 references, 4 tables.

46022 **(EPRI-CS—4178-Vol.1) First joint symposium on dry $SO_2$ and simultaneous $SO_2$/NO/sub x/ control technologies: proceedings. Volume 1. Fundamental research and process development.** (Acurex Corp., Mountain View, CA (USA)). Jul 1985. 457p. (CONF-841155—Vol.1). Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI85920790.

From 1. joint symposium on dry SO/sub 2/ and simultaneous SO/sub 2//NO/sub x/ control technologies; San Diego, CA, USA (13 Nov 1984).

Forty-six papers describing recent advances in dry sorbent injection technologies for $SO_2$ control were presented at the 1st Joint Symposium on Dry $SO_2$ and Simultaneous $SO_2$/NO/sub x/ Control Technologies. These papers covered the following topics: fundamental research; pilot-scale development of furnace injection; burners for simultaneous $SO_2$/NO/sub x/ control; post-furnace $SO_2$ removal; process integration and economics; sorbent availability and costs; and field applications and full-scale testing. The proceedings are published in two volumes: Volume 1 - Fundamental Research and Process Development; Volume 2 - Power Plant Integration, Economics, and Full-Scale Experience.

46023 **(NYSERDA—84-19) Cost impact of potential RCRA changes on New York State utility coal waste disposal. Final report.** Baker, M. Jr. (Baker (Michael), Jr., of New York, Inc., NY (USA)). Nov 1983. 122p. NYSERDA, Two Rockefeller Plaza, Albany, NY 12223. File Number TI85901971.

This report quantifies the cost impacts of potential RCRA/NYSDEC Part 360 regulatory changes affecting the management of ash, scrubber sludge, and low volume utility wastes in New York State. The major objective of the study is to estimate the incremental cost impacts (1983 dollars) of two regulatory scenarios on the disposal of projected statewide 1991 waste quantities. Sequential work tasks used to accomplish the project objective are as follows: (1) formulation of a statewide baseline description of coal-fired power generation in New York State; (2) selection and development of representative upstate and downstate case studies; (3) conceptual design of the case study sites under both regulatory scenarios; (4) cost estimation at each case study site for regulatory compliance under current conditions and both scenarios; and (5) application of case study results (annual, levelized unit disposal costs) to projected state wide 1991 waste tonnages. An annual levelized cost (1983 dollars) of 87.7 million dollars was computed to be the statewide cost for disposal of projected 1991 utility waste tonnages in accordance with existing NYSDEC regulations. Under Scenario 1 (large volume wastes non-hazardous/low volume wastes hazardous), this cost would increase by a factor of 1.1 to 92.3 million dollars. Under Scenario 2 (large volume wastes hazardous), the base cost of 87.7 million dollars would be increased by a factor of 2.2 to 196 million dollars.

46024 **(STEV-FBA—85-12) Utilization of peat ashes in cement and concrete.** Tuutti, K. (Statens Energiverk, Stockholm (Sweden)). Dec 1984. 18p. (In Swedish). (CM-T—84084). NTIS (US Sales Only), PC A02/MF A01. File Number DE85752554.

A minor amount of peat ashes might be used on sintering cement clinkers. Ashes are not suitable for ordinary concrete. They have some pozzolanic properties and the peat ashes could be used for environmental reasons. They might come useful for soil binding, sealing of waste depositories and to binding metal hydroxides in sludge.

46025 **(STEV-FBA—85-13) Laboratory infiltration experiments with peat ashes on surfaces.** Lundgren, T. (Statens Energiverk, Stockholm (Sweden)). 1985. 41p. (In Swedish). NTIS (US Sales Only), PC A03/MF A01. File Number DE85752552.

Two different ashes have been studied, one coming from a fluidized bed and the other from a kiln. Infiltration of compacted ashes has been studied on two inclined planes, 1:25 and 1:5. The first type let through only 0.13 mm rain per hour before the flow started on the surface, and the second type 0.5 mm. The infiltration capacity will correspond to 60 to 93% of the permeability. The slope of the plane has only a slight influence. The evaporation from the surfaces is not well known. The amount of rain which may infiltrate and form leaching water in the ashes will correspond to 120-140 mm and 280-380 mm rain per year, respectively. The leaching properties of the two ashes are not alike. The content of salts in the first type has a maximum at a flow of 0.2 pore volumes whereas the contents from the kiln ashes are even.

46026 **(BG-Trans—7197) Process for the conversion of sulpur compounds.** (British Gas Corp., London; Uranerzbergbau G.m.b.H. und Co. K.G., Bonn (Germany, F.R.)). 1985. Translation of German Patent 3,321,515, December 20, 1984. 9p. NTIS, PC A02/MF A01. File Number DE85902048.

A process is proposed for the conversion of sulfur compounds, in which the sulfur atom is present in a positively charged state. It is carried out under anaerobic conditions using sulfate-reducing bacteria in the presence of substance containing organic carbon with the formation of hydrogen sulfide and carbonate-containing compounds. It results in a noticeably less costly reduction of sulfate compounds than known chemical process. The sulfates can be utilized as starting material for the production of sulfur especially sulfuric acid and sulfur compounds which are not easy to dispose of are converted into substance which can be disposed of harmlessly.

## 0109 Environmental Aspects

*REFER ALSO TO CITATION(S) 45988, 45989, 45991, 46017, 46018, 46036, 47214*

46027 (DOE/METC—85/6018-Vol.1, pp 381-392) **Investigation of leachability of lignite fly ash enhanced road base materials.** Garcez, I.; Tittlebaum, M.E. (Louisiana State Univ., Baton Rouge). May 1985. NTIS, PC A21/MF A01. File Number DE85008620. (CONF-850304—Vol.1).

From 7. international symposium on ash utilization; Orlando, FL, USA (4 Mar 1985).

Enormous amounts of coal fly ash are produced by the utilities industry resulting in a significant disposal problem. This abundance along with its self-hardening properties led the Louisiana Department of Transportation and Development (LA DOTD) to utilize fly ash as a soil stabilizer for road bases. However, the LA DOTD is primarily concerned with the strength of the material and has not studied its leaching characteristics. During this study, a total of three samples, a 30% lignite fly ash/soil mixture, lignite fly ash, and soil, were leached following the EPA multiple extraction procedure and analyzed by inductively Coupled Argon Plasma Spectrometry (ICAP). Results indicate that little change in leachate quality of lignite fly ash was caused by the soil stabilization process. This insignificant alteration is attributed to the low cation exchange capacity of the soil. ICAP analysis revealed that levels of As, Cd, Fe, Mn and Pb were above recommended standards set by the EPA. 7 references, 6 figures, 9 tables.

46028 (DOE/METC—85/6018-Vol.1, pp 436-444) **Evaluation of trace element migration rates through a clay till beneath a fly ash disposal area.** Johnston, H.M.; Chan, H.T.; Ash, P.O. (Ontario Hydro, Toronto). May 1985. NTIS, PC A21/MF A01. File Number DE85008620. (CONF-850304—Vol.1).

From 7. international symposium on ash utilization; Orlando, FL, USA (4 Mar 1985).

Environmental hydrogeological investigations have been conducted in the clay overburden beneath an active (since 1969) fly ash disposal site in order to assess the potential impact of contaminant releases on the local groundwater regime. Laboratory experiments were conducted to predict the retardation capacity and diffusive transport rates of arsenic, selenium, cadmium and zinc in the

clay till and, in the case of arsenic, were compared to in situ migration rates beneath the fly ash disposal area. The results of this study show that the clay overburden has a substantial capacity to retard the migration of trace elements and demonstrates the practical application of clay liners for trace element attenuation in landfill design. 11 references, 5 figures, 3 tables.

46029 (INIS-mf—9758, pp vp) **Radioactivity emissions from peat fired power plants.** Mustonen, R. (Finnish Centre for Radiation and Nuclear Safety, Helsinki). 1984. NTIS (US Sales Only), PC A08/MF A01. File Number DE85781601. (CONF-8410282—Absts.).

From 7. Nordic Society for Radiation Protection ordinary meeting; Copenhagen, Denmark (10 Oct 1984).

Radionuclide concentrations in combustion peat and in its ash products and radionuclide emissions with different particle sizes of fly ash from a 100 MWsub(t) peat fired power plant are presented. The greatest activity emissions are associated with the smallest size fraction, below 1.3μm. Activity emissions per input fuel energy with the average ESP collection efficiency of 94% are estimated for different radionuclides. They vary from 0.7 mBq $MJ^{-1}$ of $^{235}U$ to 320 mBq $MJ^{-1}$ of $^{40}K$. The average $^{210}Pb$, $^{210}Po$ and $^{137}Cs$ emissions are estimated to be 200 mBq $MJ^{-1}$, 300 mBq $MJ^{-1}$ and 62 mBq $MJ^{-1}$, respectively. The $^{210}Po$ emission of 300 mBq $MJ^{-1}$ from a 100 MWsub(t) peat fired power plant for example, is calculated to cause the maximum concentration of about 600 nBq $m^{-3}$ in the ground level air. (author).

46030 (ORNL/FETEP—4) **Environmental, health, and safety assessments for direct coal liquefaction. Volume 4. Plant emissions and control technology status.** Irvine, A.R.; Singh, S.P.N.; Villiers-Fisher, J.F.; Roseberry, L.M. (Oak Ridge National Lab., TN (USA)). Aug 1985. Contract AC05-84OR21400. 75p. NTIS, PC A04/MF A01; GPO Dep. File Number DE85018084.

Direct liquefaction of coal produces not only liquid fuels but also undesirable substances, if released in large amounts, could be damaging to the environment and human health. This report reviews the published information collected during direct liquefaction pilot plant operations on source terms for the likely effluents and on the applicable environmental control technologies. This information is used to assess the current status of liquefaction environmental control technologies and the remaining relevant research and development needs. This review leads to the conclusion that the environmental problems are not insurmountable, and direct liquefaction technology has been sufficiently developed to allow progress in facility and process design, should the need arise. 24 refs., 4 figs., 20 tabs.

46031 **Fracture flow of groundwater in coal-bearing strata.** Schubert, J.P. (Argonne National Lab., IL). *University of Kentucky, Office of Engineering Services,* [*Bulletin*] *UKY BU;* 61-73(Dec 1980). (CONF-801263—).

From Symposium on surface mining hydrology, sedimentology and reclamation; Lexington, KY, USA (1 Dec 1980).

Fractures are of considerable importance to groundwater flow through lithified coal-bearing strata. Laboratory tests on core samples in many different studies in the northern Appalachians and northern Great Plains show sandstones, siltstones, shales, and claystones with air permeabilities ranging from less than $10^{-10}$ to 2.4 x $10^{-6}$ m/s. Generally, the air permeabilities were less than $10^{-8}$ m/s. These core tests indicate extremely low intergranular hydraulic conductivities and, in many cases, little or no difference is seen between sandstones and shales. Various aquifer tests, using wells in the same locations, invariably showed hydraulic conductivities to be much greater ($10^{-8}$ to $10^{-4}$ m/s) than those estimated by laboratory techniques. In addition the hydraulic conductivity of highly fractured rock can be $10^{2}$ to $10^{3}$ times greater than slightly fractured rock. Even shales can be highly transmissive when extensively fractured. Rock joints and coal cleats occur in all coal basins, but their distribution and orientation may be variable. The greatest concentration of fractures usually occurs in faulted areas and in narrow fracture zones less than 100 m below ground surface. The majority of large inflows through rock into surface and underground mines occur at the faults and fracture zones. By studying and understanding more about the structural control of fractures in coal basins, the larger inflows possibly could be avoided. This would reduce pumping and water treatment costs and lessen the depletion of groundwater resources in surrounding areas.

## 0110 Reserves And Exploration

46032 (DOE/ER/10988—3) **Peat in modern swamps mimics coal origins 300 M years ago.** Given, P.H.; Ryan, N.J.; Rhoads, C.A.; Spackman, W.; Stout, S.; Painter, P.C.; Boon, J.J.; de Leeuw, J.W.; Pugmire, R.J.; Alemany, L. (Pennsylvania State Univ., University Park (USA). Coll. of Earth and Mineral Sciences; FOM-Instituut voor Atoom-en Molecuulfysica, Amsterdam (Netherlands); Technische Hogeschool Delft (Netherlands); Utah Univ., Salt Lake City (USA). Dept. of Fuels Engineering). Jul 1985. Contract AC02-81ER10988. 12p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85017606.

Peat swamps can provide excellent models of ancient coal-forming processes. Peats of differing salinity and vegetational cover exhibit different trends of chemistry with depth, which have been studied in order to clarify ideas of coal origins. Thus changes with depth of phenolic structures determined by pyrolysis/gas chromatography/mass spectrometry reflect changes in plant source and partial microbial degradation of lignin, which will be reflected in the structure of coals that may form later. 12 refs., 3 figs.

## 0120 Mining

*REFER ALSO TO CITATION(S) 46051*

46033 (IIASA-RR—84-13) **Resource requirements and economics of the coal-mining process: a comparative analysis of mines in selected countries.** Astakhov, A.; Gruebler, A. (International Inst. for Applied Systems Analysis, Laxenburg (Austria)). Jun 1984. 214p. NTIS, PC A10/MF A01. File Number TI85902108.

This report examines the natural resource requirements and economics of the resource extraction process, taking coal-mining activities as an example. Coal was chosen for the study because it is receiving growing attention as the fossile energy resource with the largest potential to contribute to the world's long-term energy supply. The computerized description of the extraction process is stored in the Coal Mines Data Base (CMDB) which was developed within the framework of this study. The data base currently holds information on 70 mines located in different countries. The analytic approach used is the first of its kind to compare resource requirements and economics of coal mines under such a broad range of geological and socioeconomic conditions. A general model of the factors influencing resource inputs and impacts of the coal-mining process is presented. Then for each of the main mining methods (opencast, conventional underground, and hydraulic underground) the principal geological and technological factors influencing the resource requirements, economics, and environmental impacts, as well as the comparative advantages and disadvantages of each mining method, are discussed. For the three main mining methods the resource requirements (including manpower, energy, materials, and land) and the economics (including construction investments and operating costs) are then quantified and their cost structures (i.e. requirements for the different operations at a mine) are examined in detail using data from coal mines in the USA, the USSR, and other selected coal-producing countries (Australia, Austria, and France).

46034 (STEV-TORV—85-4) **Final report concerning the project -Deep working method Haerjedalen for fuel peat-.** Holmlund, I.; Muenther, M. (Statens Energiverk, Stockholm (Sweden)). 1985. 70p. (In Swedish). NTIS (US Sales Only), PC A04/MF A01. File Number DE85752524.

Peat, with a mean water content of 87.5%, was mined using an excavator and stored in 6 m wide banks. The drying process was then followed during 20 months (two summers and one winter). After the storage period, a water content of 81% was achieved. Tests of artificial drying were performed in a Bell peat press and in a steam dryer.

**46035 (STEV-TORV—85-5) UKAB system for peat production. Final report.** Nystroem, K. (Statens Energiverk, Stockholm (Sweden)). Nov 1984. 173p. (In Swedish). NTIS (US Sales Only), PC A08/MF A01. File Number DE85752526.

The municipal heat and power utility UKAB of Uppsala, Sweden plans to use 235000 tons of dryed pulverized peat fuel/year. The peat is to be mined in the county of Haerjedalen and will be shipped by rail to Uppsala. In this project, different methods for peat mining and production have been tested and evaluated, including both sod peat and milled peat production systems. Since the demand for dry matter content is lower for this project than on the systems for direct fuel peat production, more frequent mining campaigns can be made, and a higher production capacity achieved.

**46036 (VTT-TUTK—321) Capacity and dust emissions of a pneumatic peat harvester.** Kallio, M.; Nylander, K., Jaervinen, T. (Valtion Teknillinen Tutkimuskeskus, Espoo (Finland)). Nov 1984. 71p. (In Finnish). NTIS (US Sales Only), PC A04/MF A01. File Number DE85752565.

The quality and the amount of the produced milled peat were studied when the properties of the production field and the way of the driving of a pneumatic harvesting machine were changed. Field research was made in July at Haukkasuo in South-East Finland. The humification degrees of the research fields were, H4 and H7. The speeds of the pneumatic harvesting machine were 4.0, 5.0 and 6.5 km/h and the air velocities at the nozzle were 33 and 25 m/s. The properties of the milled peat were found out by measuring the thickness of the milled layer, the moisture, the density particle size distribution before and after the harvesting of the spread and at the stockpile. The biggest peat amount (dry substance) was harvested from a thick (over 20 mm), less humificated spread and from a thin (less than 15 mm), more humificated, very dry spread. The biggest harvests (wet basis) were obtained from the spreads of over 20 mm. The decrease of the air speed decreased the gathered peat amount clearly. In the stockpile the gathered peat was on average 8%-units drier than in the thin spreads and 14%-units drier than in the thick spread. The average particle size was unchanged between the samples from the spread and the samples from the stockpile. The dust emissions were usually below 3% of the harvested milled peat.

## 0130 Transport And Handling

*REFER ALSO TO CITATION(S) 45987*

**46037 (DOE/PC/70003—T5) Coal pretreatment for two stage liquefaction. Quarterly report, April 1-June 30, 1985.** Derbyshire, F.J.; Luckie, P.T. (Pennsylvania State Univ., University Park (USA). Coll. of Earth and Mineral Sciences). 1985. Contract FG22-84PC70003. 20p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016252.

The overall objectives are to investigate the fundamental problems and technical feasibility of selectively separating coal constituents and to determine the effects of the substantial removal of inorganic components or individual macerals on coal liquefaction. To achieve these aims, the following specific tasks will be undertaken: (1) procurement, characterization and storage of coals and solvents; (2) coal pretreatment; (3) characterization of size density fractions; and (4) coal liquefaction research. Attempts have been made to fit a liberation model to the size density fractionation of subbituminous coals. Two different approaches were tried and neither was considered to be satisfactory due to certain basic assumptions which had to be made. Work is continuing on this problem. Considerable progress has been made in the construction of the autoclave reactor for conducting thermal and catalytic liquefaction experiments in either a single or two-stage sequence. It is estimated that the system will be operational by the end of October. Tubing bomb experiments have confirmed that low temperature pretreatment, while not apparently influencing net conversion, has a strong influence on increasing the oil to asphaltene ratio in the liquefied products. Other experiments have shown that the presence of an active catalyst does not fully compensate for deficiencies in solvent quality. 1 ref.

**46038 (DOE/PC/70796—4) Effect of maceral properties on the comminution of coal. Technical progress report, April 1-June 30, 1985.** Bodily, D.M. (Utah Univ., Salt Lake City (USA). Dept. of Fuels Engineering). 1985. Contract FG22-84PC70796. 9p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016116.

The results of swelling of four coal samples from the Pennsylvania State University coal sample bank in various solvents are shown in Table 1. The swelling of coals varies with the properties of the coals. Sample PSOC-161, an anthracite, shows no swelling in any of the solvents. There is some reversal of the order of swelling in different solvents. This may reflect differences in the maceral contents. For example, PSOC-858 is high in semifusinite while PSOC-2 is high in sporinite. The relative degree of swelling of these two coals in pyridine is the reverse of that in THF. There is substantial extraction of coal in the pyridine. The density gradient separation of the PSOC samplels is shown in Figures 4 and 5. The density distributions agree well with the maceral compositions. The heavy lines indicate fractions that have been combined to produce larger fractions. Vitrinite fractions and semifusinite fractions were obtained from PSOC 858 and PSOC-2. Sporinite, vitrinite and inertinite fractions were obtained from PSOC-297. A single vitrinite fraction was obtained from fraction PSOC-161. The effect of swelling in methanol on the porosity of Hiawatha coal was studied. Methanol causes only a few percent swelling but this is enough to disrupt the pore structure and decrease the surface area of the sample. Upon heat treatment, the surface area of the unswollen coal decreases, while that of the once-swollen coal increases. 3 refs., 6 figs.

**46039 (NP—5770361) State-of-the-art of stockpile engineering, illustrated by the example of a stockpile constructed by the cone shell technique and reclaimed by means of a bucket tube reclaimer.** Hofmann, L. (Technische Hochschule Aachen (Germany, F.R.). Fakultaet fuer Bergbau und Huettenwesen). 9 Mar 1984. 175p. (In German). NTIS (US Sales Only), PC A08/MF A01. File Number DE85770361.

With increasing stockpile size, stockpile capacities become less dependent on the winning, transport and processing facilities but storage costs will rise. The author attempts to define the optimum stockpile size as a function of various operating parameters, i.e. stockpile shape, equipment, stockpile construction and reclaiming, and environmental aspects. One major problem of big stockpiles is the homogenisation of the material, i.e. the precalculation of the quality of the material removed on the basis of the volumes and qualities of the materials stored. The author describes modern stockpile construction techniques and presents a mathematical/geometrical model of a longitudinal stockpile constructed by the cone shell technique and reclaimed by means of a bucket tube reclaimer (Fa. Weserhuette). The model permits precalculations of the volumes reclaimed and the related quality parameters.

**46040 (NP—5770367) Abrasion and movement of bulk goods on belt conveyors.** Bick, H. (Technische Univ. Berlin (Germany, F.R.). Fachbereich Bergbau und Geowissenschaften). 25 Jan 1984. 125p. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE85770367.

The processes during bulk goods transport on belt conveyors are described by suitable models. Important parameters are the shifting of the bulk material itself, the abrasion of bulk material particles, and the movement of the bulk material relative to the belt. Equations are presented for calculating the abrasion and the relative movement. The abrasion is also determined experimentally for different materials as a function of the constructional parameters of the belt conveyors. The experiments served to validate the theoretical findings.

**46041 (NP—5770373) Improvement of the curing behaviour of briquets containing a polyvinylalcohol binder and influence of calcium oxide on their stability and emission values.** Cieslik, W.G. (Technische Hochschule Aachen (Germany, F.R.). Fakultaet fuer Bergbau und Huettenwesen). 23 Feb 1984. 104p. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE85770373.

Black coal that has not undergone thermal pretreatment can only be briquetted with the help of binders. Rising prices and stricker injunctions to protect the environment call for new binders. This work was aimed to test mixtures of polyvinyl alcohols and calcium oxide for their suitability as binders. Not only the stability upon use of small amounts of binder is investigated, but also the influence of lime on the course of stability and the $SO_2$ emissions. Combustion tests were conducted with anthracite briquets containing a polyvinylalcohol binder, and the content of water as well as its influence on the stability and curing speed were determined. Furthermore the influence of the compression strength on the stability of briquets, the curing behaviour of briquets pressed with the use of synthetic material, their solubility in cold water and sulfur retention are analysed.

46042 **(UCRL—92992) Granular flow: advanced research and technology development (AR and TD) contract review.** Walton, O.R. (Lawrence Livermore National Lab., CA (USA)). 19 Jul 1985. Contract W-7405-ENG-48. 13p. (CONF-850878—5). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85017267.

From AR and TD direct utilization contractors' meeting; Morgantown, WV, USA (13 Aug 1985).

The objective of the granular flow project is to develop an understanding for and an ability to predict the flow behavior of granular solids. New research tools are being developed as part of this task in the form of new two- and three-dimensional discrete particle computer models that can provide detailed information on both the microscopic and macroscopic deformations occurring in flowing granular solids. These computer models calculate the motion of each individual particle in an assembly of many inelastic, frictional particles responding to applied loads, boundaries and/or gravity. New interparticulate force models have been developed that realistically simulate collision behavior between spheres and disks under rapid shearing conditions. A new two-dimensional steady-state shearing model, using periodic boundaries on all sides of a primary calculational cell has been used to determine the rheologic properties of assemblies of disks and the dependence of these rheologic properties on the shear rate, and on the inelasticity and surface friction properties of the disks. Real boundaries and gravity have recently been added to this two-dimensional model. Three-dimensional steady-state shearing and real boundary models with spherical particles are under development. When these are completed direct comparisons can be made between various existing laboratory studies and the three-dimensional computer simulations. 8 figs.

46043 **(VTT-TUTK—325) Handling alternatives of weakly decomposed surface peat and compacting of it.** Lindh, T.; Jaervinen, T. (Valtion Teknillinen Tutkimuskeskus, Espoo (Finland)). Dec 1984. 133p. (In Finnish). NTIS (US Sales Only), PC A07/MF A01. File Number DE85752567.

The handling alternatives of weakly decomposed peat in different stages of peat production and peat transport is studied. The most realistic alternatives are the following: - deep ploughing of surface peat for mixing weakly decomposed and more decomposed peat layers before fuel peat production - production of peat granules, because of their good drying properties, depending on the granulating method for fuel peat or horticultural peat - milled peat method for horticultural peat and litter peat production and for raw material of field pellets. To be good raw material for field pellets milled peat must be drier than normal fuel peat and that is why the stockpilling techniques and storing techniques must partaicularly be considered in the milled peat method. Laboratory scale tests were made in the second part of the investigation. The main objects were to find out the possibilities to granulate milled peat by using two different methods, when the moisture scale of feed is wide, - by pressing peat with a screw through a hole matrix to cylindrical granules and - by rolling peat with a granulating plate to spherical granules. The granulating plate tests as batch process were made at a moisture scale of 40-83% and as a continous process at a moisture scale of 82-86%.

## 0140 Combustion

*REFER ALSO TO CITATION(S) 46982, 46986, 46987, 47237, 47238*

46044 **(BNL—36856) Role of coal water mixture in utility coal conversion.** Bhagat, N.; Butcher, T. (Brookhaven National Lab., Upton, NY (USA)). May 1984. Contract AC02-76CH00016. 115p. NTIS, PC A06/MF A01; GPO Dep. File Number DE85017856.

To indicate the role of coal water mixtures (CWM) in utility coal conversions, the pertinent technical, economic, environmental, and regulatory factors involved in CWM conversion are reviewed. CWM technology provides an attractive option for utility companies to convert to coal. There appear to be no major technical problems in CWM production and use that cannot be overcome. Environmental considerations, however, play an important role in utilities' decisions to convert to coal. In general, coal conversions would be seriously impeded if the installation of flue gas desulfurization units cannot be avoided, as it now can because of the DOE program, and they are also inhibited by present uncertainties regarding impending acid rain regulations. Preliminary estimates of the economics of conversion seem attractive; however, site-specific evaluation is needed to justify conversion in a given situation. Although conversion to pulverized coal appears competitive with that to CWM, some non-economic factors tend to favor CWM over PC.

46045 **(DOE/MC/14322—1800) Construction and utilization of a large-scale coal-fired pressurized fluidized-bed facility.** Zakkay, V.; Kolar, A.; Sellakumar, K.M.; Cisset, H.; Panunzio, S.; Franceschi, J.; Miller, G.; Joseph, A.; Ganesh, A.; Ponnusami, K. (New York Univ., NY (USA). Dept. of Applied Science). Aug 1985. Contract AS21-80MC14322. 258p. NTIS, PC A12/MF A01; 1; GPO Dep. File Number DE85013685.

New York University (NYU), has designed and constructed a sub-pilot scale pressurized fluidized-bed combustor (PFBC) at the Antonio Ferri Laboratories, Westbury, Long Island, NY. The basic feature of this experimental research facility is a well-instrumented, 30-inch diameter coal combustor capable of operating up to 10 atm, and is provided with a liberal number of ports, making it a versatile unit for the study of fundamental in-bed phenomena, and for component and instrumentation development. Additionally, the overall design features make it a flexible facility for solving a variety of industrial research problems. Lignite combustion studies showed the amenability of the fuel for efficient combustion in the PFBC system. Combustion efficiencies over 99% were obtained in tests with dolomite, alumina, and sand bed materials under operating conditions of 7 atm pressure, 1500 to 1600°F bed temperature, 4 to 5.5 ft/s fluidizing velocity, and 15 to 30% excess air. The study of physical and chemical changes of bed materials vs. running time showed that replenishment of bed material may be necessary to maintain desired particle size in the bed. The sand bed agglomeration problem faced in AFBC's seemed to have been contained at least during the 40-hr test at 7 atm pressure. Attempts were made to quantify the alkali vapor emission in exhaust flue gases. The measurements indicated alkali emissions of around 3000 ppB though suggested limits for gas turbines is only 20 ppB. The alkali earth compounds (Na, Ca, Mg) inherent in lignite ash appear to effectively limit the $SO_2$ emissions into the atmosphere to 400 ppM compared to an EPA limit of about 600 ppM. The gas composition and temperature profiles obtained along the coal feed axis indicate significant thermochemical changes within a very short coal stream flow distance inside the bed. 15 refs., 40 figs., 64 tabs.

46046 **(DOE/MC/16537—1764) Characterization of high temperature vapor phase species and vapor-solid interactions of import to combustion and gasification processes in the energy technologies.** Gole, J.L. (Georgia Inst. of Tech., Atlanta (USA). School of Chemistry). Nov 1983. Contract AC21-81MC16537. 147p. NTIS, PC A07/MF A01; 1; GPO Dep. File Number DE85013691.

The alkali oxides LiO, NaO, and KO and the alkali hydroxide KOH have been studied. Emphasis has been on the determination of bond energies and the first electronic spectra for these species. In addition the oxidation of silicon to produce the metal mon-

oxide has been characterized using chemiluminescent techniques in order to determine the SiO bond energy in an experiment independent of mass spectrometry. Several experimental configurations have been tested as a means for generating intense, stable, and long lasting chemiluminescent emission from the alkali oxides NaO and KO and the alkali hydroxides NaOH and KOH. Studies have been carried out primarily at elevated pressures ($10^{-1} \rightarrow 10$ torr) as an aid to spectroscopic analysis and the determination of molecular constants. Oven systems have been developed which circumvent problems in flame formation and stability common to the alkali hydroxides and oxides but not present in typical chemiluminescent metal oxidation systems. Most pronounced among these is the extremely efficient formation of extensive particulate matter which appears to result from the formation of alkali hydroxide and alkali oxide polymers. Experiments have been initiated to characterize the particulate matter formed in the potassium-$N_2O$ system. Here we have been successful in employing a combination of mass spectroscopy and EPR spectroscopy and are attempting to extend this work further using laser Raman spectroscopy, High Temperature mass spectroscopy, and x-ray crystallogrpahy.

**46047 (DOE/PC/80752—T1) Detailed model for practical pulverized coal furnaces and gasifiers. Quarterly technical progress report No. 1, May 1-July 31, 1985.** Smith, P.J.; Smoot, L.D. (Brigham Young Univ., Provo, UT (USA). Combustion Lab.). 31 Aug 1985. Contract FG22-85PC80752. 53p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85017358.

This work is aimed at improving extending the comprehensive modelling research of the past ten years at the BYU Combustion Laboratory to practical industrial applications. The general objective of this study is to improve and extend the generalized 2-dimensional, pulverized combustion and gasification code (PCGC-2) for application to large-scale, practical (3-D) configurations, and to evaluate and implement the resulting code on an industrial scale. This endeavor is being pursued only after substanial evaluation of the general modelling methods in the simpler 2-dimensional configuration. It is recognized that all of the physical and chemical issues are not resolved and that the task is not only one of extending the code numerically to 3-dimensions, but of conducting further work on subcomponents as a vital part of this research contract and of on-going research by the other investigators. Five tasks have been identified for the four year study, and work on three of the five has been initiated. Study tasks and first year tasks are outlined in the report. 53 refs.

**46048 (NP—5752643) Experimental fluidized-bed coal-fueled plant at Toender.** Svendsen, J.J.; Michael, M.; Haugaard, E.; Hansen, A. (Burmeister og Wain Energi A/S, Copenhagen (Denmark)). Jul 1984. vp. (In Danish). Burmeister og Wain Energi A/S, Copenhagen (Denmark). EFP-81.

Under 'Energy Research Program 81' Burmeister and Wain Energi A/S has been supported with DDK 1.6 million for re-building and development of an existing Fluid/Bed pilot plant. The existing fluidized bed steam boiler has been re-built to an 4.5 MW hot water boiler in such way that: 1. A large spectrum of fuels can be tested by combustion, 2. The energy released, will be accumulated in 2 hot water accumulators of each 50 $m^3$, Approx, 27 GJ can be accumulated. The accumulated energy is used for heating of BWE's workshop. 3. In case when the hot water accumulators are filled the released energy can be let out as saturated steam. 4. In the most important part of the boiler the heat transfer can be measured. 5. At the same time 2 different fuels can be burned, or desulphurization of the flue gas can be carried out by inlet of alkaline material (limestone) to the bed. Public authorities and Danish industry, may use the plant for their test programs. This is limited to a total amount of 50 days per year.

**46049 (NP—5770363) Mathematical modelling of bubble-forming fluidized-bed coal combustion plants.** Hartleben, B. (Siegen Univ. (Gesamthochschule) (Germany, F.R.). Fachbereich 11 - Maschinentechnik 1). 25 Nov 1983. 131p. (In German). NTIS (US Sales Only), PC A07/MF A01. File Number DE85770363.

Mathematical modelling of fluidized-bed coal combustion chambers becomes increasingly important as experimental investigations are tedious and costly especially on a semi-industrial and industrial scale. The author describes a simulation method for calculating the steady-state and dynamic operating characteristics of a fluidized-bed combustion chamber in a steam generation plant. The method comprises a plant model, balance equations, and a solution algorithm. The fluidized-bed combustion chamber is devided up into several balance sections, one on top of the other, and mass and energy balances are established separately for each section. Apart from the reaction mechanisms of fluidized-bed coal combustion, also the $SO_3$ absorption, the NOsub(x) reduction, the interphase mass transfer, the heat exchange on the reactor walls and submerged tube clusters, the coupled evaporator and superheater circuits, and the external fly dust recirculation by means of a separator cyclone are considered. The quality and validity of the model was assessed by comparing the theoretical results with the experimental operating results of a semi-industrial experimental facility of Bergbau-Forschung GmbH.

**46050 (VTT-TIED—407) Fuel use of coal. Pt.2. New applications of coal combustion technique, combustion of pulverized coal and coal-liquid mixtures.** Miettinen, M.; Mutanen, K. (Valtion Teknillinen Tutkimuskeskus, Espoo (Finland)). Jan 1985. 99p. (In Finnish). NTIS (US Sales Only), PC A05/MF A01. File Number DE85752574.

In the literature review new applications of production, handling and combustion of pulverized coal and coal-liquid mixtures have been studied. The aim is to present new combustion technology for coal and appraise its suitability in Finland. The existing alternatives to produce energy will be completed by using coal in places, where it is possible technically and economically. Entirely new equipment and methods will also be found to utilize the properties of coal. The most important applications to be studied are centralized coal grinding, combustion of pulverized coal in oil/gas boilers, combustion of ultrafine pulverized coal and coal-liquid mixtures. The use of coal in Finland has significance especially in Southern-Finland and on the coast, where there are no peat resources and when using coal together with domestic fuels. Central coal grinding, delivery and combustion seem to be appropriate technology also in Finland. Pilot and field experiments and cost analyses are needed to find the best alternatives for pulverizing technology, transport and handling and combustion technology. The combustion properties and burner applications of coal-water (CWM) and coal-oil (COM) mixtures are studied. A summary of plants which produce or use COM or CWN is presented and the applications of these mixtures and the development potentials, also in Finland, are estimated.

## 0150 Marketing And Economics

*REFER ALSO TO CITATION(S) 46627*

**46051 (IEA/ICEAS—C5) Cost and availability of Colombian coal.** Jamieson, E.D. (Jamieson Resources, West Vancouver, British Columbia (Canada)). Mar 1985. 77p. B. File Number TI85902112.

The study of Colombian coal prospects was commissioned by IEA Coal Research to provide member countries with an overview of the potential impact of Colombian coal exports on the world thermal coal trade over the next 15 years. Three requirements were considered essential to accomplish the objectives of the study. Those requirements were: all-round technical expertise in coal development, production and utilization; good economic evaluation capability; a comprehensive knowledge of Spanish. The report examines the physical, technical, economic, political and financial constraints and imperatives that are shaping the emerging modern coal industry in Colombia. The reasons for the relatively sudden and large-scale entry of Colombian thermal coal exports into the world market are assessed and their commercial prospects evaluated. The important contributions of foreign developers and foreign investment in new developments are analyzed in relation to the Colombian balance of payments record and creditworthiness with international lending institutions. Conclusions are drawn on projected production of coal for internal use in Colombia and on projected levels of commercially viable thermal coal production that will be able to enter the world market at competitive prices.

The principal conclusions from the study are that up to 35 million tonnes per year of Colombian thermal coal could be marketed at prices close to current world levels. However, because of present slackness in world demand and apparent hesitation by international lending institutions to advance capital for projects beyond the two now under development at Cerrejon, the amount of Colombian coal entering the world market is unlikely to exceed 16 million tonnes per annum until the 1990's. 56 refs., 33 figs., 40 tabs.

### 0160 Health And Safety

*REFER ALSO TO CITATION(S) 46830, 46874, 46875, 47308, 47407, 47408, 47409, 47410, 47414, 47415, 47416, 47418, 47419, 47422, 47425*

**46052 (STEV-TORV—85-8) Occupational health and safety in handling and combustion of peat.** Nordberg, G.; Stroemquist, L.H.; Lagerkvist, B.; Lundstroem, N.G.; Thorsson, J. (Statens Energiverk, Stockholm (Sweden)). Dec 1984. 61p. (In Swedish). NTIS (US Sales Only), PC A04/MF A01. File Number DE85752548.

The working environment in peat handling is similar to that of some other fields, and it is important to use the existing knowledge. There is however a need for more research in some areas in order to assess risks of medical nature. Characterisation from a chemical, physical and biological point of view of peat and peatdust are import areas, which have not yet been performed. Toxicology of peatdust is another field where studies should be initiated.

**46053 Workplace injury experience of female coal miners in the United States.** Watson, A.P.; White, C.L. (Oak Ridge National Lab., TN). *Archives of Environmental Health;* **39**: No. 4, 284-293(Jul-Aug 1984). Contract W-7405-ENG-26.

Analysis of the 1978-1980 accident history of female coal miners collected by the Mine Safety and Health Administration (MSHA) has identified significant differences in injury severity due to mine type, source and nature of injury, geographic region, age class, and part of body injured. Approximately 4% of all female coal workers were involved in a lost-time accident as compared to 7% for males; female workers lost approximately 1.1 days each as compared to 2.4 days for males; and 0.01% of the female work force were fatally injured as compared to 0.05% among males. Most injuries to both female and male workers involved back sprains. The majority of remaining injuries are sprains and fracture to joints and bones of the limbs. 20 references, 5 figures, 2 tables.

### 0170 Legislation And Regulations

*REFER ALSO TO CITATION(S) 46023*

## 02 PETROLEUM

### 0203 Drilling And Production

**46054 (PTB-Ra—17) Enhanced radioactivity due to natural oil and gas production and related radiological problems.** Kolb, W.; Wojcik, M. (Physikalisch-Technische Bundesanstalt, Braunschweig (Germany, F.R.). Radioaktivitaet). Feb 1985. 73p. (In German). B. File Number DE85752253.

Within the scope of a research contract, the following aspects are considered: External radiation exposure at production sites; internal radiation exposures during cleaning operations such as removing of scale by sand blasting; problems of waste disposal; internal radiation exposure due to radon inhalation by consumers; the origin of the high radium content of brines from oil and gas fields. Enhanced dose rates up to 50 μSv/h have been found at the external surface of saltwater tanks, but 72% of the 160 sites investigated did not show any increase above the natural background. Brines from gas contained radium-226 up to 286 Bq/l and scale up to 1 kBq/g. In brines and scale from oil fields radium-228 was usually the dominating radionuclide. Some samples contained significant amounts of lead-210 and even actinium-227, too, but practically no uranium or thorium. The radon-222 concentrations in natural gas samples varied between 0.004 and 4 Bq/l with an average value of 0.6 Bq/l. Related radiological problems are discussed.

**46055 (RISO-M—2503) BETA3A reservoir simulation program. User's manual.** Bagger, H.; Ladekarl Thomsen, K. (Risoe National Lab., Roskilde (Denmark)). Jan 1985. 89p. NTIS (US Sales Only), PC A05/MF A01. File Number DE85752650.

EFP-82.

BETA3A is a three-dimensional three-phase Black-Oil reservoir simulation program, and this report is the user's manual for the program. The complete input is described and information about the output is given. The program has facilities for restart. They are discussed and necessary instructions are given. Error checking is done by the program both during the input processing and the actual simulations. Different error messages may be given. Errors causing a stop of simulation are defined in the report. The program uses eight files for input and output. These are defined and the necessary record lengths are given.

**46056 (RISO-M—2515) Optimal formulation of simple finite elements.** Krenk, S. (Risoe National Lab., Roskilde (Denmark)). May 1985. 20p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85752662.

EFP-84.

Spatial discretization introduces size and mesh orientation errors associated with the nonhomogeneous nature of the discretization. These errors are described by Fourier analysis and compensated by introducing a weight function in the variational formulation of the discretized equations. Particular attention is given to the Laplace and the identity operators on a regular quadrilateral mesh. Three weight factors are identified and determined to give optimal dispersion properties, and the importance of the formulation of the identity operator is demonstrated. Standard difference operators appear as special cases for orthogonal meshes. The procedure is related to one-point quadrature finite elements.

**46057 (STF—28A84012) Miscible displacement. Yearly report 1983.** Glasoe, Oe.; Hagen S. (SINTEF, Trondheim (Norway)). Feb 1984. 128p. NTIS (US Sales Only), PC A07/MF A01. File Number DE85752559.

The report presents the results obtained from high pressure displacement tests and phase behaviour studies in the North Sea gas-oil mixtures and on three-component hydrocarbon systems. The minimum miscibility pressure (MMP) of three gas-oil hydrocarbon systems is determined using the slim tube method. A graphical presentation of the same hydrocarbon mixtures as pseudoternary systems is given, and predicted MMP is related to MMP from the displacement tests. Experiments with three component hydrocarbon systems are performed in order to check the significance of data obtained from displacement tests with the slim tube equipment built at the Petroleum Technology Research Institute at SINTEF. Correlations for predicting MMP required for miscible displacement with three-component systems are presented. The accuracy of experimentally determined MMP with the high pressure slim tube equipment is estimated to 3 percent. 8 references.

**46058 Detailed validation of a liquid and heat flow code against field performance.** Tsang, C.F.; Doughty, C. (Lawrence Berkeley Laboratory). *Society of Petroleum Engineers of A.I.M.E. (American Institute of Mining, Metallurgical and Petroleum Engineers), Paper;* **SPE13503**: 61-70(Feb 1985).

The numerical code PT, which calculates liquid and heat flow in a saturated porous or fractured porous medium, has been validated against a series of field experiments involving the injection and subsequent production of hot water into a confined aquifer. The layered structure of the aquifer and strong buoyancy effects, indicating highly coupled liquid and heat flows, provide a stringent test of the code's ability to model the real world.

**46059 Moving elements for reservoir transport processes.** Carey, G.F.; Mueller, A.; Sepehrnoori, K.; Thrasher, R.L. (Univ. of Texas). *Society of Petroleum Engineers of A.I.M.E. (American Institute of Mining, Metallurgical and Petroleum Engineers), Paper;* **SPE13511**: 135-144(Feb 1985).

The authors consider a class of convection-dominated flows fundamental to reservoir simulation, and their approximate solution using finite element techniques and moving meshes. Both the solu-

tion field and the coordinate functions enter as primary unknowns in the resulting problem statement. Hence the mesh evolves with the solution, and the method is particularly well-suited to those problems in which tracking of sharp solution fronts is important. Examples of particular interest related to petroleum reservoir simulation are the model convection diffusion, Burgers', and Buckley Leverett equations, which are considered in the numerical studies. They consider effective solution techniques and system integration, as well as questions related to the use of constraints for limiting the permissible distortion of the mesh.

## 0207 Marketing And Economics

*REFER ALSO TO CITATION(S) 46066, 46627*

**46060 (OCS/MMS—85-0036) Atlantic Index, June 1984-January 1985.** Lynch, C.W.; Molajo, D.D. (Rogers, Golden and Halpern, Inc., Reston, VA (USA)). 1985. 117p. OCS Information Program, 1951 Kidwell Drive, Suite 601, Vienna, VA 22180. File Number TI85902012.

Chapter 1 describes the Outer Continental Shelf (OCS) leasing process from a national perspective, discusses the 5-year leasing program, and presents information on the July 1982 OCS oil-and-gas leasing schedule and the tentative milestone chart issued subsequent to the July 1982 schedule. Chapter 2 discusses the current status of lease sales in the Atlantic OCS Region from June 1984 through January 1985 and presents updated information on future sales scheduled for the region. Chapter 3 describes the steps in the pre- and postlease processes. Relevant documents produced from June 1984 through January 1985 are listed by lease sale for each step. Chapter 4 reports on the ongoing MMS programs that support the OCS leasing process. The appendixes include directories of federal and state OCS-related contacts and other information pertinent to the OCS leasing process. 9 figs., 20 tabs.

**46061 (OCS/MMS—85-0037) Alaska index, May 1983-January 1985.** Molajo, D.D. (Rogers, Golden and Halpern, Inc., Reston, VA (USA)). 1985. 85p. OCS Information Program, Minerals Management Service, 1951 Kidwell Drive, Vienna, VA 22180. File Number TI85902055.

Chapter 1 describes the Outer Continental Shelf (OCS) leasing process from a national perspective, discusses the 5-year leasing program, and presents information on the July 1982 OCS oil-and-gas leasing schedule and the subsequently issued tentative milestone schedule. Chapter 2 discusses lease sales held since May 1983 and future sales scheduled for the region. Chapter 3 describes the steps in the pre- and postlease processes. Relevant documents produced from May 1983 through January 1985 are listed by lease sale for each step. Chapter 4 reports the ongoing MMS programs that support the OCS leasing process. The appendixes include directories of Federal and State OCS-related contacts and other information pertinent to the OCS leasing process.

**46062 (UT/CES-PS—24) Optimum combination of leasing systems on public lands.** McDonald, S.L. (Texas Univ., Austin (USA). Center for Energy Studies). Dec 1984. 37p. NTIS, PC A03/MF A01. File Number DE85902040.

Bonus bidding for oil and gas leases on public lands has been a reasonably satisfactory system for capturing the average rent available while being neutral with respect to economic decisions such as abandonment. However, it places a heavy burden of risk and uncertainty on the lessee. There is some reason to believe that social gains are to be had from shifting some of the risk and uncertainty to the lessors (governmental units). Profit-share or royalty bidding tends to accomplish such a shift. However, optimality seems to call for a combination of bonus bidding and profit-share (or royalty) bidding, the latter on wildcat tracts and the former on drainage tracts. Profit-share bidding is somewhat superior to royalty bidding, and the best definition of "profit" for the purpose is profits in excess of a normal return on investment. The combination suggested above may be especially desirable in a program of accelerated leasing of public lands. 2 figs.

## 0208 Waste Management

*REFER ALSO TO CITATION(S) 46020, 46399*

**46063 (DOE/BC/10749—3) Consistency monitoring for recycled lubricating oil basestocks. Final report.** Munro, R.G.; Hsu, S.M.; Weeks, S.J. (National Bureau of Standards, Washington, DC (USA)). Sep 1985. Contract AI19-82BC10749. 142p. NTIS, PC A07/MF A01; 1; GPO Dep. File Number DE85017994.

A comprehensive study of lubricating base oil characteristics was performed to identify measurement tests for monitoring the consistency of the oil from a base oil source, particularly for rerefined oils. The data base compiled during this work contains test results on 143 oil samples. Four producers of virgin oils and six producers of rerefined oils supplied samples from their regular production basestocks each month for 13 months. A reference oil from a single virgin stock was also used as a source during each of the 13 months. Fourteen independent laboratories then conducted measurements of the chemical, physical, and performance characteristics of the 143 oil samples. The resulting data base was published in an NBS special publication (NBS SP661). A detailed analysis of the data base is presented. Emphasis has been given to the requirements for and the selection of a reduced number of variables representative of the entire data base. A major portion of the selection process was an assessment of the significance of the candidate monitoring variables with respect to the performance variables. The latter effort involved both univariate and multivariate techniques along with the development of a systematic methodology for univariate multilinear functional modeling. 16 refs., 8 figs., 7 tabs.

**46064 (PB—85-195063/XAB) Developing a used-oil recycling activity in developing countries: general considerations and alternative available technologies. Working paper series No. 1.** (United Nations Industrial Development Organization, Vienna (Austria)). 7 Feb 1985. 27p. NTIS, PC E03/MF A01.

UNIDO pub on development of used oil recycling in developing countries covers (1) significance of such recycling for the environment and pollution control; (2) economic implications of rerefining of used lubricants from engines, machinery, etc; (3) prefeasibility factors: quantity and quality of used oils: collection system; potential uses; marketing assessment; (4) the implementation stage for facilities; (5) choice of technology. Flow charts, information sources. Additional reference: petroleum products.

**46065 (BG-Trans—7154) Waste water treatment by catalytic wet air oxidation treatment of oil refinery waste water.** Hashimoto, H.; Tanto, R.; Inagaki, I. Translated from *Kankyo Gijutsu ;* 8: No. 2, 190-198(1979). 34p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85902075.

To remedy the deficiencies of previous methods of wet air oxidation technology used for treatment of waste water, research efforts have been focused on a search for suitable catalysts, whereby a catalyst producing pronounced effect has been identified. A method offering outstanding recovery of the specified catalyst has also been developed and refined into a coherent system. The proposed method features an extremely high oxidation degradation index for organic substances ocurring in waste water. High-concentration organic waste water can be treated through application of an oxidizing liquid circulation method offering economic catalyst recovery.

## 0209 Environmental Aspects

*REFER ALSO TO CITATION(S) 47280*

**46066 (PB—85-199693/XAB) Draft environmental impact statement for proposed oil and gas lease sales 104 and 105, Gulf of Mexico OCS (Outer Continental Shelf) region.** Christopher, J.A.; Reinhardt, J.L.; Johnstone, W.T. (Minerals Management Service, Metairie, LA (USA). Gulf of Mexico OCS Regional Office). May 1985. 555p. (OCS/MMS—85/0006). NTIS, PC A24/MF A01.

This EIS is a description of the environmental aspects and impacts of oil and gas activities resulting from these lease sales or the states bordering the Gulf of Mexico. It provides a description of the area, affected environment, and environmental consequences; it discusses the proposed actions, issues and areas of concern, and the major differences of holding these lease sales.

46067 **(SAND—85-1532) Subsidence due to fluid withdrawal: a survey of analytical capabilities.** Engi, D. (Sandia National Labs., Albuquerque, NM (USA)). Aug 1985. Contract AC04-76DP00789. 202p. NTIS, PC A10/MF A01; GPO Dep. File Number DE85017883.

An extensive review of the literature was conducted in the area of land subsidence due to the withdrawal of fluids. A method of categorizing the citations was developed to facilitate identification of references relating to specific fields of interest. A brief review of the materials represented by the bibliography indicates the state-of-the-art within this area. The bibliography (containing 1225 citations) is presented in its categorized form. 5 figs., 3 tabs.

## 0220 Transport, Pipelines, And Handling

46068 **(RISO-M—2490) MULTWO: Compositional computer model for transient oil/gas two-phase flow. 1. year progress report.** Rathmann, O.; Dall, H.; Gottlieb, L.; Asp Hansen, E.; Hansen, J.A. (Risoe National Lab., Roskilde (Denmark)). Feb 1985. 89p. NTIS (US Sales Only), PC A05/MF A01. File Number DE85752646.

The development of a compositional and transient computer model, MULTWO, for oil/gas two-phaseflow has been initiated. A preliminary version with compositional and two-fluid description but with simplified flow pattern and friction models has been coded, and a catalogue of advanced flow pattern and friction models for future implementation has been prepared. New friction models for stratified-, annular- and slug flow have been developed for this catalogue. In connection with the computer model development a PhD study has been established on the fundamental fluid- and thermodynamics in two-phase flow.

46069 **(SRD-R—326) In-service reliability data for underground cross-country oil pipelines.** Blything, K.W. (UKAEA Safety and Reliability Directorate, Culcheth). Oct 1984. 31p. United Kingdom Atomic Energy Authority, Culcheth, Warrington, England £5.00. File Number TI85901920.

In this study the aim has been to specify mean failure rates for different pipeline categories, which have been classified by failure cause, fluid carried and pipe size, also to specify mean defect sizes for the various failure cause categories. Data relating to pipelines have been separated into those carrying oils and those carrying gases. This report analyses the oil pipeline data which has been gathered from Western Europe, Canada and the USA. The Western Europe historical accident data is the most detailed and relevant to the UK pipeline network. These data have been analysed to determine failure frequency and the parameters which influence it, and it is found that cause, pipe geometry, fluid and environment all contribute, with cause and pipe diameter predominating. A data base has been prepared which specifies mean failure rate with 95% confidence limits for four cause categories over a range of diameters. External corrosion was found to occur principally in heated pipelines transporting heavy fuel oil, and it is suggested this cause could be neglected for modern unheated lines. The major threat to pipeline integrity is from earth-moving activities, and this cause is classified as Third Party Activity. Excavators, deep ploughing tools and hole borers punch holes through pipe walls or dent the surface leaving a defect from which subsequent failure may occur. The other two causes, which have lower failure probabilities, are classified as Mechanical and Natural Hazard. The Mechanical category includes failures due to defects in the pipe material and welds, with cracks in longitudinal seam welds being fairly frequent. Failures due to Natural Hazards are infrequent and appear to be independent of diameter with loss of support allowing bending leading to circular fracture being the general problem. 8 refs., 8 figs., 10 tabs.

## 0230 Properties

*REFER ALSO TO CITATION(S) 45974, 46063*

46070 **Mechanisms of synfuel degradation 1. Effects of organic nitrogen compounds on the stability of a shale derived diesel fuel.** Cooney, J.V.; Beal, E.J.; Huzlett, R.N. (Naval Research Laboratory, Washington, DC). *Liquid Fuels Technology;* 2: No. 4, 395-426(1984).

A reliable accelerated fuel stability test regimen has been developed and applied to the study of the storage stability of a shale derived diesel fuel marine (DFM). The results of a survey of nitrogen compounds as dopants in a stable shale DFM base fuel indicate that some pyrroles and indoles may play significant roles in storage stability. A complete stability test matrix has been developed for the temperatures of 43, 65 and 80°C, for time periods between 4 and 179 days, and for a ten-fold concentration range of a model dopant, 2,5-dimethylpyrrole (DMP). Stability was defined by the amount of total insoluble material (filterable sediment and adherent gum) produced after stress, and also by the amount of titratable peroxide present in the filtrates of stressed fuel samples. A very regular pattern for insolubles formation was found within the test matrix. Deposit formation rates exhibited a first-order dependence on DMP concentration, with an apparent activation energy of 11-12 kcal/mol. The sediment was found to contain 12% nitrogen and 18-20% oxygen irrespective of the stress conditions employed.

## 0240 Storage

*REFER ALSO TO CITATION(S) 46070*

46071 **(DOE/FE—0049) Strategic Petroleum Reserve. Technical and performance criteria: level 1.** (USDOE Assistant Secretary for Fossil Energy, Washington, DC. Strategic Petroleum Reserve Program Office). Aug 1985. 20p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85017691.

This document establishes the Strategic Petroleum Reserve (SPR) Program top-level technical and performance requirements against which the technical design, construction, performance, and test criteria for the SPR will be developed at successive levels of detail. The scope of this document shall apply to all elements of the Strategic Petroleum Reserve over which the Department of Energy (DOE) has purview. These requirements are to serve as the baseline for subordinate technical criteria documentation and related specifications, including: (1) configuration of the total SPR; (2) design and development of SPR sites; and (3) SPR systems performance, test and evaluation.

46072 **(KI—1983-8) Internal corrosion protection for oil storage tanks - evaluation of practical experiences.** Sandberg, B. (Swedish Corrosion Inst., Stockholm). Oct 1983. 40p. (In Swedish). NTIS (US Sales Only), PC A03/MF A01. File Number DE85752557.

Cathodic protection is one of the type-approved methods of internal corrosion protection for oil storage tanks. The method has been used for several years, so it has been considered urgent to evaluate its effect. The Swedish Corrosion Institute, with funds from the Swedish council for Building Research, therefore initiated a project conerning internal cathodic protection of oil storage tanks. The object of this study was, by observations of numerous tanks in service, to determine the efficiency of the method and the quantity of anode consumption. It was also intended to determine the quantities of water present on the bottom of oil storage tanks as well as certain water parameters of significance for corrosion. The inspection of 21 tanks, showed that cathodic protection, if properly installed, is a fully adequate method for internal corrosion protection of oil storage tanks of steel. Of the tanks inspected, 19 were entirely uncorroded. The other two had a few shallow pits. By determination of the weight loss of 21 anode chains it was established that in the majority of tanks today, equipped with 10-year anodes, the life of the majority of tanks today, equipped with 10-year anodes, the life of the anodes is sufficient. The quanitity of bottom water varies within wide limits, depending chiefly on the number of refills and the quantity of water in the oil. Cathodic protection has

an alkalizing effect on the bottom water, which in itself reduces the corrosion.

**46073 Strategic Petroleum Reserve: budget and policy implications of the proposed moratorium. Tenth report by the Committee on Government Operations together with additional views.** Washington, DC; Government Printing Office (1985). 58p.

Transmitted to the Committee of the Whole House on the State of the Union, US House of Representatives, Ninety-Ninth Congress, First Session.

In February, 1985 the Subcommittee on Environment, Energy, and Natural Resources initiated an indepth review of the Administration's proposal to impose an "indefinite moratorium" on the Strategic Petroleum Reserve (SPR) program. The proposed moratorium would halt further site development and oil purchases for the Reserve. As part of its FY86 budget request, the Administration proposed to halt the SPR program at the end of FY85, at which time it is expected to hold 489 million barrels of oil. Until the recent moratorium proposal, the policy of both the Administration and Congress was to continue to develop and fill SPR so that it would hold a total of 750 million barrels of oil by 1990. The Subcommittee began its investigation of the Administration's proposed moratorium and its effects on the SPR program, in part, because the moratorium represents a significant change in the policies and programs followed by this and previous Administrations and Congresses. Administration officials have contended that the moratorium will not diminish the nation's short- or long-term energy security and, at the same time, will generate significant budgetary savings. Despite such assertions, information obtained by the Subcommittee and by GAO, which assisted in the investigation, raises serious concerns about the moratorium's effects with regard to overall US energy security, specific SPR policies and programs, the cost-effectiveness of the proposed moratorium, and the long-term reliability of the SPR system.

# 03 NATURAL GAS

## 0302 Geology And Exploration

**46074 (DOE/MC/20422—1873) FY 1984 USGS annual report.** Law, B.E.; Spencer, C.W. (Geological Survey, Denver, CO (USA)). Jul 1985. Contract AI21-83MC20422. 90p. NTIS, PC A05/MF A01; GPO Dep. File Number DE85013606.

The purpose of this report is to provide geologic data and interpretations in these Rocky Mountain basins that will ultimately lead to an improved understanding of the nature and distribution of tight gas-bearing reservoirs and aid recovery technology. The report is in two parts; the first is a discussion of the geologic characterization of low-permeability gas reservoirs in selected wells from the Greater Green River Basin; the second is a summary report of investigations conducted during FY-1984 in the Piceance Creek Basin, including the MWX site. Both parts have been processed separately for inclusion in the Energy Data Base.

**46075 (DOE/MC/20422—1873, pp 4-61) Geologic characterization of low-permeability gas reservoirs in selected wells, Greater Green River Basin, Wyoming, Colorado, and Utah. Part I.** Law, B.E.; Pollastro, R.M.; Keighin, C.W. Jul 1985. NTIS, PC A05/MF A01. File Number DE85013606.

In FY 1984 USGS annual report.

Large gas resources occur in low-permeability Upper Cretaceous and lower Tertiary reservoirs in the Greater Green River Basin of Wyoming, Colorado, and Utah. Most of the gas-bearing reservoirs are overpressured beginning at depths of 8000 to 11,500 ft (2440 to 3500 m). The reservoirs are typically lenticular nonmarine and marginal marine sandstones. In-situ permeabilities to gas are generally less than 0.1 md and porosity ranges from 3 to 12 percent. Secondary porosity caused by the dissolution of framework grains and cements, is the dominant type of porosity. Gas accumulations are characterized by the presence of up-dip water-bearing reservoirs and down-dip gas-bearing reservoirs. The top of these overpressured gas-bearing reservoirs cuts across structural and stratigraphic boundaries and is not associated with any particular lithologic unit. These overpressured accumulations are the result of gas accumulating at rates greater than it can leak off into lower-pressure sequences. Data from reference wells indicate that in the deeper parts of the basin the relatively closed nature of this system imposes severe restrictions on the ability of gas to migrate appreciable distances from the interbedded organic-rich hydrocarbon source rocks. Consequently, the temporal relationships of hydrocarbon generation and migration with respect to the development of structural and statigraphic traps are not as important in these unconventional reservoirs as in more conventional reservoirs. The more important factors related to gas generation and occurrence are source rock (quantity and quality), organic maturation (gas generation caused by heat and time), thermal history, formation pressure, and porosity and permeability variations. 52 refs., 26 figs.

**46076 (DOE/MC/20422—1873, pp 62-84) Results of USGS MWX and Piceance basin research.** Spencer, C.W.; Johnson, R.C.; Pitman, J.K.; Nuccio, V.F. Jul 1985. NTIS, PC A05/MF A01. File Number DE85013606.

In FY 1984 USGS annual report.

Investigations conducted during FY 1984 in the Piceance Creek Basin, including the MWX site are summarized. Topics covered are: MWX reservoir pressures; reservoir characterization which includes petrographic and mineralogic characteristics, porosity and permeability character; relationship of petrography to log analysis problems; isotopes of minerals in natural-fracture cements; geophysics; surface fracture studies; and gas generation studies. 16 refs., 3 figs.

## 0303 Drilling, Production, And Processing

*REFER ALSO TO CITATION(S) 46054, 46055, 46056, 46058, 46059, 46074, 46075*

## 0306 Marketing And Economics

*REFER ALSO TO CITATION(S) 46060, 46061, 46062, 46066, 46084, 46627*

**46077 (DOE/EIA—0130(85/06)) Natural Gas Monthly, June 1985.** (USDOE Energy Information Administration, Washington, DC. Office of Oil and Gas). Aug 1985. 159p. NTIS, PC A08/MF A01; 1 - GPO; GPO Dep. File Number DE85017382.

Current data on natural and supplemental gas consumption, disposition, production, prices, storage, imports, and exports in the United States are provided for each year from 1978 through 1985, with monthly data for the most recent 3 years. Some data are also given by state or city; some data are also given for previous years. Operating and financial data for major interstate natural gas pipeline companies, as well as data on filings, ceiling prices, and transportation under the Natural Gas Policy Act of 1978, are also included. Explanatory notes, a discussion of data sources, and a glossary are included. Three reports previously published as separate annuals are now published in this report. The three are: "Underground Natural Gas Storage in the United States" (DOE/EIA-0239); "US Imports and Exports of Nautral Gas" (DOE/EIA-0188); and "Main Line Sales of Natural Gas to Industrial Users" (DOE/EIA-0129). Titles of feature articles for this issue are: (1) Residential and natural gas sales per customer in northeastern United States; and (2) Domestic natural gas reserves and production dedicated to interstate pipeline companies, 1984. 6 refs., 32 tabs.

**46078 (NP—5902098) Mandatory carriage and the price of natural gas.** (Illinois Commerce Commission, Springfield (USA)). 14 Nov 1983. 12p. NTIS, PC A02/MF A01. File Number DE85902098.

In assessing the need for mandatory carriage, it is useful to consider the industry's basic structure. The production segment of the industry is characterized by few buyers and many sellers. There are only 28 major interstate pipelines (buyers) dealing with 15,000 gas producers (sellers). Absent mandatory carriage, a producer generally has only one, or at the most several, pipeline purchasers. Because of this position, pipeline wield significant leverage at the pro-

ducer end of their systems; leverage that can be used to disadvantage producers. The economic power of the pipelines is just as great at the other end of their systems. Local distribution companies usually have only one pipeline supplier despite the existence of 15,000 producers. Consequently, distributors have little choice but to pay the price the pipelines ask. Mandatory carriage breaks this lock and allows distributors to purchase directly from thousands of gas sellers thus improving their competitive position. Simply the option to purchase from other suppliers lessens a pipeline's power and provides distributors an opportunity to lower gas prices for their customers. In summary, only a competitive natural gas industry provides the necessary structure and discipline that allows price to equate market supply with market demand. A prerequisite to this competitive gas industry is that the pipeline's monopoly power be constrained by mandatory contract carriage.

46079 **Evolving environmental policy relating to the U.S. gas industry.** Coleman, J.A. (U.S. Department of Energy). pp 16-21 of Proceedings of the 1981 International Gas Research Conference. Rockville, MD; Government Institutes, Inc. (1982). (CONF-810909—).

From International gas research conference; Los Angeles, CA, USA (28 Sep 1981).

One key element in our national energy policy is increased reliance on market decisions. For example, energy prices will be expected to more truly reflect production costs and realities of market demand. Energy consumers will determine their choices of the types and amounts of energy they wish to utilize. This market approach should be recognized as a basic tenent of the Administration's Economic Recovery Program. Another major element of current energy policy is in the area of emergency planning by Government for potential energy supply emergencies such as disruptions in world oil markets. Activities that are being taken to implement this policy are increasing the Nation's oil stockpiles, eliminating government controls that hamper the private sector from dealing with supply interruptions, and developing realistic plans for government to fulfill its responsibilities in an emergency situation.

## 0307 Waste Management

*REFER ALSO TO CITATION(S) 46026*

## 0308 Environmental Aspects

*REFER ALSO TO CITATION(S) 46066, 47187*

46080 **(EUR—9680-EN) Verification of various models for the expansion and dispersion of heavy gas clouds on the basis of large scale experiments.** Kirsch, J.; Schnatz, G. (Commission of the European Communities, Luxembourg. Directorate-General for Information, Market and Innovation). 1985. 164p. Commission of the European Communities, Luxembourg. Office of Official Publications of the European Communities.

The main objective of the project has been the validation of a series of heavy gas dispersion models by means of the Thorney Island large scale releases. The large variety of models published in the literature has been reduced to such models which are frequently used and differ significantly in their basic assumptions. The experimental data of 15 instantaneous heavy gas releases at Thorney Island have been processed. Comparison calculations have been performed for nine characteristic experimental data sets. The results show good agreement for the downwind distance profile of the concentration at ground level for a number of models. Large differences in shape and absolute value of the concentration profiles are obtained for elevations from 2.4 m up to 6.4 m. Some main model deficiencies have been identified. Recommendations for the applicability of the different models are given.

46081 **(SRD-R—252) Validation calculations for the code GASEX2.** Martin, D. (UKAEA Safety and Reliability Directorate, Culcheth). Aug 1983. 58p. United Kingdom Atomic Energy Authority, Wigshaw Lane, Culcheth, Warrington, England WA3 4NE. File Number TI85901932.

This report describes some validation calculations undertaken for the two-dimensional hydrodynamic code GASEX2. The GASEX2 calculations are compared with results from other codes, analytical solutions and experiments. The calculations cover a number of different situations but all involve the propagation of shock waves. No detailed description of the GASEX2 code is given in this report. 22 refs., 35 figs., 5 tabs.

46082 **Simulations and studies of heavy gas dispersion using the SLAB model.** Morgan, D.L. Jr.; Kansa, E.J.; Morris, L.K. (Lawrence Livermore National Lab., CA). pp 147-150 of Symposium on turbulence & diffusion. Boston, MA; American Meteorological Society (1983). Contract W-7405-ENG-48.

From 6. symposium on turbulence & diffusion; Boston, MA, USA (22-25 Mar 1983).

The SLAB model is a one-dimensional (1-D), time-dependent model suitable for computer simulations which describes the diffusion and gravity flow of a heavy gas released into the atmosphere. The properties of the air-gas cloud are treated explicitly in their dependence on the downwind direction. When strong turbulent mixing occurs within the cloud, the properties are sufficiently constant in the crosswind directions to justify the 1-D simulation. The model currently consists of six coupled, partial differential equations (PDEs). These equations express the conservation of air and gas masses, the downwind and horizontal crosswind momenta, and the thermal energy. One PDE defines the cloud width, and an algebraic formula defines the equation of state. Height and other properties are calculated from the proceeding quantities. Since height and width are determined, the model is quasi three-dimensional (3-D). Submodels calculate turbulent diffusion, heat flow, friction, and height-dependent wind speed. Diffusion is modeled by the entrainment of air into the cloud surface. The entrainment rate depends on the air-cloud density and velocity differences, and on the friction and convection velocities of the cloud.

46083 **Effects of a dense vapor cloud on turbulence near the ground.** Cederwall, R.T.; Rodean, H.C.; Shinn, H.J. (Lawrence Livermore National Lab., CA). pp 345-347 of Symposium on turbulence & diffusion. Boston, MA; American Meteorological Society (1983). Contract W-7405-ENG-48.

From 6. symposium on turbulence & diffusion; (22-25 Mar 1983).

Safety research related to hazards from potential accidental releases of liquefied natural gas (LNG) is discussed. As part of this program a series of LNG spill experiments was conducted at China Lake, California, in the summer of 1980. The purpose of these experiments was to study the transport and dispersion of vapor from the LNG spills. An extensive array of instrumentation was deployed to collect micrometeorological and gas concentration data. Wind velocity data were processed to describe the mean wind field and levels of turbulence. Most experiments were run under neutral to unstable atmospheric stability, with wind speeds greater than 5 m/s. Under these conditions, the mean wind field and ambient turbulence levels were relatively unaffected by the presence of the vapor cloud. One experiment was done in low wind speed, slightly stable conditions. In this instance, the mean wind and ambient turbulence were modified within about 100 m downwind of the spill point by the cloud.

## 0310 Legislation And Regulation

*REFER ALSO TO CITATION(S) 46078*

46084 **(NP—5902099) Natural gas legislation: a consumer's perspective.** Lemon, J.R. (Illinois Commerce Commission, Springfield (USA)). Aug 1983. 20p. NTIS, PC A02/MF A01. File Number DE85902099.

This report evaluates three major legislative proposals: accelerated decontrol of both old and new wellhead prices as proposed by the Reagan administration (S.615, H.R. 1760); imposition of new natural gas price controls at lower levels as proposed by Congressman Gephardt (H.R. 2154); and conversion of interstate gas pipelines to common carriage as proposed by Senators Dixon and Percy

and by Congressman Corcoran (S. 1119, H.R. 2565). The reference or base case scenario used in the evaluation is a continuation of the Natural Gas Policy Act of 1978 (NGPA) with no legislative modifications. First, projections of wellhead and burner-tip natural gas prices are presented for the period 1983-1990, and then consumer benefits under the different scenarios are estimated. All projections presented assume that legislation takes effect as of January 1, 1983 and that normal weather patterns are experienced. All prices identified in the report are given in 1982 dollars unless otherwise indicated. 5 figs., 1 tab.

## 0320 Transport, Pipelines, And Handling

*REFER ALSO TO CITATION(S) 46068*

**46085 (CONF-8208205—Pt.4) Infrastructure for transportation of petroleum offshore.** (Norsk Petroleumsinstitutt, Oslo). 1982. 77p. NTIS (US Sales Only), PC A05/MF A01. File Number DE85752558.

From Offshore Northern Seas conference and exhibition; Stavanger, Norway (24 Aug 1982).

This volume of the proceedings contains three papers covering: advantages of submarine two phase flow transportation of gas and condensate in the North Sea; gas gathering on the Norwegian continental shelf (STATPIPE); offshore Northern Norway, strategical and economical approaches for transportation of the materials - various alternatives available. Separate abstracts have been prepared for each paper of the volume.

**46086 (CONF-8208205—Pt.4, pp T-II/1 1-31) Advantages of submarine two phase flow transportation of gas and condensate in the North Sea.** Roux, A. 1982. NTIS (US Sales Only), PC A05/MF A01. File Number DE85752558.

From Offshore Northern Seas conference and exhibition; Stavanger, Norway (24 Aug 1982).

The two phase flow transportation systems for offshore field production have several advantages as compared to single phase transportation. The construction of an offshore plant for separating, treating, stocking and evacuating the condensate is avoided. From an economic point of view the investments are reduced by 20%. From a technical point of view, although the pipelines cross the Norwegian deep, pressure losses in the two phase flow are nevertheless similar to those of the single phase flow. In certain cases, the advantages of the two phase flow transportation system are even more obvious: deeper oceans and larger cost differences between sea and land constructions. The two phase flow is, however, more difficult to master than traditional single phase flow. Calculations of pressure loss and flow rate are much more complex. In order to solve this problem a research project, sponsored by EEC, has been carried out. The most important outcome of this project is a computer program, whereby pressure, temperature, liquid content and flow regime can be calculated at any point along a two phase flow pipeline in steady flow. 16 figures.

**46087 (CONF-8208205—Pt.4, pp T-II/2 1-15) Gas gathering on the Norwegian Contintental Shelf (Statpipe).** Espedal, T. (Statoil (Norway)). 1982. NTIS (US Sales Only), PC A05/MF A01. File Number DE85752558.

From Offshore Northern Seas conference and exhibition; Stavanger, Norway (24 Aug 1982).

In 1981 a decision was made to build the Gas Transportation System Statpipe to transport gas from the fields Statfjord, Gullfaks and Heimdal to countries on the Continent. The Statpipe system includes a pipeline for rich gas from the Statfjord area to Kaarstoe near Stavanger, an NGL terminal/plant at Kaarstoe and a pipeline for dry gas from Kaarstoe and Heimdal to the Ekofisk Centre. Statpipe will initially transport 5 billion m*sp3* rich gas from Statfjord and Gullfaks to the terminal at Kaarstoe and 7 billion m*sp3* dry gas from Statfjord, Gullafaks and Heimdal to Ekofisk, for further transport to Emden. At the Kaarstoe terminal the rich gas is separated into a dry and a wet gas steam. The wet gas will be fractioned into a total of 1270 tons of NGL and transported by ship. The pipeline system is crossing the Norwegian Trench twice at a maximum water depth of 300 m, and the construction and operation of Statpipe represents a technological and industrial challenge. In addition to supplying gas from 1986, the Statpipe System has excess capacity to receive gas from new fields.

**46088 (CONF-8208205—Pt.4, pp II/4 1-25) Offshore North Norway - A new gas province. Strategic and economical approaches for transportation of the materials - various alternatives available.** Bjoentegaard, H.O. 1982. NTIS (US Sales Only), PC A05/MF A01. File Number DE85752558.

From Offshore Northern Seas conference and exhibition; Stavanger, Norway (24 Aug 1982).

Exploration since 1980 of two areas north of 62 parallel in the Norwegian Sea has shown the presence of producible dry natural gas. The northernmost of these areas, the Troms area, is located just north of the 71 parallel. If natural gas should be developed in Northern Norway, with its small population, it is obvious that a major portion of the gas would have to be transported to the large gas markets in Europe. For this reason a preliminary study of various alternatives for the transportation of the gas has been initiated. These alternatives are: transport as gas in a pipeline, either offshore Norway or onshore through Norway or Sweden, as a liquid (LNG) or as a chemical product (ammonia and methanol). The cost of transportation has been found to be high and ways of reducing it must be studied whatever transportation system is selected. 7 figures.

**46089 (KI—1983-7) High pressure pipelines for natural gas - recommendation for corrosion protection at road or railway crossings.** Camitz, G.; Sandberg, B. (Swedish Corrosion Inst., Stockholm). Sep 1983. 4p. (In Swedish). NTIS (US Sales Only), PC A02/MF A01. File Number DE85752556.

This recommendation was drawn up by the Swedish Corrosion Institute after consultation with several Swedish authorities and private companies. It is recommended that pipelines are installed without casings in all places possible. If casings must be used and steel casings are chosen they should be provided with an external protective coating with good resistance to mechanical damage unless the corrosivity of the soil is proven to be low and no metallic contact between casing and gas pipe can be anticipated. Concrete casings need no coating unless the soil is aggressive to concrete. Where casings are used extra internal cathodic protection with the anodes placed in the space between the pipes should be installed.

**46090 (BGC/MRS/M—14935) Experience and technical know-how for the safe operation of sour gas field pipelines.** Bruckhoff, W.; Geier, O.; Hofbauer, K. Translated from *Erdoel-Erdgas-Zeitschrift ;* **100**: No. 10, 339-346(Oct 1984). 24p. NTIS (US Sales Only), PC A02. File Number DE85902078.

The cause for the rupture of the Woestendoellen S - Westeresch sour gas high pressure pipeline on February 12, 1982 was the result of the combined effect of stress orientated hydrogen induced cracking and hydrogen induced sulfide stress corrosion cracking. The hydrogen induced damage to the pipe steel was triggered by a corrosive electrolyte which must have been present in the form of a glycol film with enhanced water content in the presence of elementary sulfur and chlorides. The water content may have been raised by re-moistening of the industrially dried gas by the reaction of oxygen with hydrogen sulfide. The oxygen was introduced into the system through the strip gas (air conditioned clean gas). The hydrogen induced damage has been reproduced in laboratory experiments under simulated pipeline conditions. The pipeline system, specifically the oxygen contaminated Eastern string and the Visbek Z6 flowline, were studied in detail. The results of statistical investigations of the gas extraction and pipeline history, chemical analyses of the deposits, theoretical considerations and examinations of pipe samples have led us to the conclusion that aggressive conditions existed at least temporarily in the Woestendoellen S - Westeresch pipeline. The monitoring of the pressure gradients and that of the lower critical pressure by the in-process computer were modified so as to be more stringent to permit early identification of pressure irregularities. The detailed investigations performed ensure that after replacement of the above cited pipelines the sour gas pipeline system can now be regarded as safe.

## 0340 Combustion

*REFER ALSO TO CITATION(S) 46394*

# 04 OIL SHALES AND TAR SANDS

## 0402 Site Geology And Hydrology

**46091 (UCID—20512) Model of hydrocarbon maturation in the Uinta Basin, northeastern Utah.** Sweeney, J.J.; Burnham, A.K.; Braun, R.L. (Lawrence Livermore National Lab., CA (USA)). Aug 1985. Contract W-7405-ENG-48. 68p. NTIS, PC A04/MF A01; GPO Dep. File Number DE85017957.

A computer model has been developed to determine the fractions and relative compositions of solid and liquid hydrocarbons and volatiles developed at heating rates and temperatures present in Green River oil shale type I kerogen retort. A thermal model of the development of Uinta Basin in Utah has also been developed to see if the kerogen pyrolysis model is valid when extrapolated to temperatures and heating rates on a geologic scale. Geophysical log data from the Altamont-Bluebell and Redwash oil fields in the Uinta Basin have been used to develop a model of the thermal history of Green River Formation stratigraphic intervals which contain Type I kerogen. The basin thermal history data, in the form of heating rates and maximum temperatures attained as a function of time, were put into the kerogen pyrolysis model to compute compositional changes in the oil and gas fraction with time. Initial results show good qualitative agreement between calculated values and actual oil compositions from published data. Uncertainties in the geologic model result from incomplete information concerning lithologic ages, timing of events, and geophysical data such as density, porosity, and thermal and pressure gradients. The inherent uncertainty in the pyrolysis model arises from simplifying assumptions made and the fact that the heating rates modeled are about nine orders of magnitude slower than rates in laboratory experiments. We feel, however, that the general agreement of these two approaches in this analysis of hydrocarbon evolution lends credence to both models. The successful application of the kerogen pyrolysis model demonstrates the utility of the approach used here as a tool in the analysis of the thermal history of geologic basins, although further experiments and model development would be required to extend the application to Type II and III kerogens. 50 refs., 25 figs., 7 tabs.

## 0404 Oil Production, Recovery, And Refining

**46092 (DOE/ER/10157—1) Investigation of the effects of selected disposables on powdered oil shale. Annual progress report, October 1979-October 1980.** Evans, R.A. (Alabama A and M Coll., Normal (USA)). [1981]. Contract FG05-80ER10157. 14p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85017192.

The goal of the present investigation is to determine the fate of several disposal (or waste) items when intimately mixed with powdered oil shale in a laboratory report. A study was designed to show whether or not the radical species accompanying shale decomposition will interact with those from the added substances (Polystyrene, Polyethylene, etc.) and produce an oil which will incorporate both shale oil fragments as well as fragments of the disposables. The disposable items used in the study were polystyrene and polyethylene. Several runs have been made using Colorado Oil Shale. Infrared analysis of oils showed pronounced aromatic character. Enchancement of oil yield occurred when using polystyrene. 1 fig.

**46093 (DOE/ER/10823—T1) Radiative heat transfer in oil shale retorting. Final report.** Huber, M.L.; Jones, M.C. ( School of Mines, Golden (USA). Dept. of Chemical Engineering and Petroleum Refining). Sep 1985. Contract AC01-81ER10823. 219p. NTIS, PC A10/MF A01; GPO Dep. File Number DE85017941.

Thesis. Submitted by M.L. Huber.

In the present study, the frequency response method has been used to investigate heat transfer in a packed bed subject to gas flow at low Reynold's numbers (less than 20). A new model was developed, the extended single particle model (ESPM), which includes axial conduction in the solid, solid to solid particle radiative transfer, gas-particle interphase transfer, and is expressed in terms of the surface temperature of the solid. The theoretical frequency response of the new model was compared with several existing differential balance models, and also with a mixing cell form of the ESPM model. Experiments were performed using four different sizes of alumina spheres, ranging from 0.003175 to 0.01905 meters in diameter, with temperatures from 600 to 1300 K and particle Reynold's numbers varying from 0.6 to 13. The model was used to obtain estimates of the heat transfer parameters h (gas particle heat transfer coefficient) and k/sub eax/ (effective axial thermal conductivity). The Nusselt number was found to follow Nu = 0.154 Re/ sup 1.48/ for 0.6 < Re < 13. The data tend to support the interpretation of Martin (1978) concerning the effect of voidage variations on the Nusselt number at low flow rates. When a radiatively participating gas was used, the Nusselt number was not significantly different from runs made with air. The estimates of k/sub eax/ showed a strong temperature and particle size dependency consistent with existing theory, and also were not altered when a participating gas was used. 79 refs., 35 figs., 13 tabs.

**46094 (DOE/LC/10783—1866-Vol.3) Volumetric heating of oilshales by electromagnetic methods. Volume 3. Effective medium theory of a heterogeneous medium.** Inguva, R.; Sen, A.D. (Wyoming Univ., Laramie (USA). Dept. of Physics and Astronomy). Oct 1984. Contract AS20-81LC10783. 34p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85007800.

The response of oil shale rods to microwave radiation in the frequency range 2 to 4 GHz is studied. The study indicates that oil shale rods are capable of sustaining wave guide modes (low Q). However, the precise nature of the modes is not yet very clear. Anisotropy effects show up in higher order modes. The loss of moisture in the shale rods leads to an increase in the resonant frequencies. 6 refs., 19 figs.

**46095 (DOE/LC/10783—1866-Vol.6) Volumetric heating of oil shales by electromagnetic methods. Volume 6. Heat conduction in heterogeneous media and volumetric heating of oil shales by electromagnetic methods.** Baker-Jarvis, J.; Inguva, R. (Wyoming Univ., Laramie (USA)). Oct 1984. Contract AS20-81LC10783. 211p. NTIS, PC A10/MF A01; GPO Dep. File Number DE85007804.

The problem of volumetric heating of oil shales by electromagnetic methods and the effects of layering on heat conduction in oil shales are studied theoretically. This study includes both a detailed examination of heat conduction in composite media, and the development of a numerical model to describe the heating process. A new solution to a heat conduction equation in heterogenous materials is developed which includes both the effects of inclusions and contact resistance. The solution is presented in terms of the associated Green function and numerical results are displayed. A new solution to the heat conduction equation is presented for materials which consist of constituents whose thermal properties vary in a discontinuous manner. This solution is also presented in terms of a Green function and an iteration technique is developed to solve the related eigenfunction problem. Numerical results are exhibited for heat flow in layered materials. A two dimensional numerical model which describes electromagnetic heating of oil shales is developed which includes equations for temperature, pressure, saturations, chemical reactions, mass conservation, and source terms. The gases are all assumed to form one bulk species and the oil is assumed to remain in liquid form. The chemical reactions include pyrolysis of kerogen and char, release of bound water, coking, and decomposition of carbonates. Porosity and permeability are dynamic functions of the organic materials. Calibration of the model is accomplished by comparison of the model results with experimental data obtained by IITRI. Nonlinear relationships for viscosity, thermal properties, and source terms are used as inputs to the model. A finite difference approximation to the differential equations is derived and solved using Newton's iteration technique. Numerical results are included and a preliminary study of the optimization of the heating process is presented. 44 refs., 63 figs.

**46096 Effect of reduced pressure on oil shale retorting. 1. Kinetics of oil generation.** Sohn, H.Y.; Yang, H.S. (Departments of Fuels Engineering and of Metallurgy and Metallurgical Engineering, University of Utah, Salt Lake City, Utah). *Industrial and Engineering Chemistry Process Design and Development;* **24**: No. 2, 265-270(Apr 1985).

The rate of oil generation in oil shale retorting under reduced pressure was determined by a nonisothermal technique. First-order kinetics adequately approximated the overall retorting rate of Colorado oil shale regardless of the type and pressure of the sweep gas. The activation energy remained relatively constant with pressure fo each sweep gas, while the preexponential factor increased as pressure decreased. The rate expressions for retorting with nitrogen and carbon dioxide were substantially the same, while retorting with water vapor produced a higher rate constant than that with nitrogen or carbon dioxide. The kinetics expression for oil generation remained relatively unchanged for different grades of oil shale containing organic matter of similar compositions.

**46097 Shale Oil Cracking Kinetics and Diagnostics.** Bissell, E.R.; Braun, R.L.; Burnham, A.K. (Lawrence Livermore National Laboratory, Livermore, California). *Industrial and Engineering Chemistry Process Design and Development;* **24**: No. 2, 381-386(Apr 1985).

Kinetic equations and diagnostic expressions are given for cracking of shale oil. Shale oil was produced in a fluidized bed at 450°C and then passed through a packed-bed cracker in which the residence time and temperature could be varied. The maximum yield obtained was approximately 110% of Fischer assay for 0.3 s at 450° in the cracking reactor. The lowest oil yield was 22% of the maximum value and was obtained for 12.3 s at 650°C in the cracking reactor. Oil yields agree fairly well at low conversions with published kinetic expressions, but a more complicated analysis was required to fit the entire range of data. Four models of varying complexity are considered. Relations are also developed between three aromatic/aliphatic ratios and the amount of shale oil cracking. Finally, data are given which demonstrate the effect of cracking on the boiling-point distribution as measured by simulated distillation.

**46098 Evaluation of oil yield losses during the retorting of oil shale at low void fractions: Part 1. The effects of particle size and resource grade.** Guffey, F.D.; McLendon, T.R. (Western Research Inst., Laramie, WY). *Liquid Fuels Technology;* **2**: No. 4, 439-461(1984).

The economics of vertical modified in situ (VMIS) retorting of oil shale can be improved by decreasing the quantity of oil shale which is mined and transported to the surface. However, decreasing the quantity of oil shale removed from the retort also decreases the void fraction in the shale bed and this can affect the retorting process. The Western Research Institute has completed a series of experiments designed to investigate the effects of different experimental parameters on retorting oil shale at low void fractions. The effects of changes in the experimental parameters, oil shale particle size and resource grade, on oil yield losses have been evaluated using previously described oil yield loss diagnostic methods. These methods show that cracking-plus-combustion losses are the major and more variable source of chemically related oil yield losses. In experiments investigating changes in oil shale particle size, these losses correlate with the temperature differential between thermocouples in the rubble and in the interior of the oil shale particles. The data from the experiments investigating the effects of changes in resource grade on oil yield losses do not follow this correlation because of additional combustion of the produced oil during the lean resource grade experiment. Coking losses from experiments investigating both parameters were found to decrease with increased heating rate of the oil shale when significant differences in the heating rate were observed.

### 0405 Properties And Composition

*REFER ALSO TO CITATION(S) 46092, 46094, 46095*

**46099 Effect of Raw Oil Shale Grade on the Kinetics of Oxidation of Carbonaceous Residue in Retorted Shale.** Kim, S.K.; Sohn, H.Y. (Univ. of Utah, Salt Lake City, Utah). *Industrial and Engineering Chemistry Process Design and Development;* **24**: No. 2, 506-507(Apr 1985).

The effect of the grade of raw oil shale on the intrinsic kinetics of oxidation of carbonaceous residue formed during retorting was investigated. The results indicate that, within the experimental uncertainty, the intrinsic reactivity of the carbonaceous residue of Colorado oil shale is independent of original grade.

### 0407 Health And Safety

*REFER ALSO TO CITATION(S) 47417*

### 0409 Waste Research And Management

**46100 (PNL-SA—11518) Approach to analysis of the environmental effects of spent oil shale disposal.** Franklin, R.E.; Wildung, R.E. (Pacific Northwest Labs., Richland, WA (USA); USDOE, Washington, DC). Jul 1983. Contract AC06-76RL01830. 32p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85017922.

This report describes a systematic approach to define the problems and mitigate potential environmental impacts associated with the disposal and reclamation of spent shale. A basic understanding of the hydrology and geochemistry of the land forms created from disposal of spent shales is needed for a quantitative description of water and solute flux for different scenarios and conditions. The approach described includes: developing an understanding of the relationship between retorting conditions and the geochemical and geotechnical properties of spent oil shale; developing conceptual models of waste piles which incorporate engineering design, construction and operational scenarios incorporating the data base into existing models of environmental processes such as those which depict water relationships, geochemical reactions, and solute transport refining the submodels through experimentation based on scientific methods; and selectively validating the submodels as the first full scale waste piles become available for observation. Initially the models would be used to set priorities for research. When validated, the models would be used to describe the long range consequences of different operational scenarios and to develop and optimize design strategies. 13 refs., 2 figs.

### 0410 Environmental Aspects

*REFER ALSO TO CITATION(S) 46100, 47234*

## 05 NUCLEAR FUELS

### 0501 Reserves

**46101 (IAEA-TECDOC—328) Geological environments of sandstone-type uranium deposits. Report of the Working Group on Uranium Geology organized by the IAEA.** (International Atomic Energy Agency, Vienna (Austria)). Mar 1985. 407p. NTIS (US Sales Only), PC A18/MF A01. File Number DE85781627.

Separate abstracts have been prepared for papers from the volume entitled Geological Environments of Sandstone-Type Uranium Deposits. This is the report of a working group organized by the IAEA.

46102 (INIS-mf—9679) **Geostatistics applied to estimation of uranium bearing ore reserves.** Urbina Galan, L.I. (Instituto Politecnico Nacional, Mexico City. Escuela Superior de Fisica y Matematicas). 1982. 123p. (In Spanish). NTIS (US Sales Only), PC A06/MF A01. File Number DE85781602.

A computer assisted method for assessing uranium-bearing ore deposit reserves is analyzed. Determinations of quality-thickness, namely quality by thickness calculations of mineralization, were obtained by means of a mathematical method known as the theory of rational variables for each drill-hole layer. Geostatistical results were derived based on a Fortrand computer program on a DEC 20/40 system. (author).

46103 (INIS-SU—299, pp 329-330) **Correlation of the uranium geology between the African and South American continents.** Barretto, P. (IAEA Correlation Working Group (Brazil)). 1984. NTIS (US Sales Only), PC A17/MF A01. File Number DE85781599. (CONF-840820—Vol.9-Pt.1-Summs.).

From 27. international geological congress; Moscow, USSR (4 Aug 1984).

Short note.

46104 (INIS-SU—299, pp 330-331) **Zheltorechenskoe uranium deposit.** Batashov, V.G.; Onoprienko, M.E.; Kudlaev, A.R. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow); Tarkhanov, A.V. (Moskovskij Geologorazvedochnyj Inst. (USSR)). 1984. NTIS (US Sales Only), PC A17/MF A01. File Number DE85781599. (CONF-840820—Vol.9-Pt.1-Summs.).

From 27. international geological congress; Moscow, USSR (4 Aug 1984).

Short note.

46105 (INIS-SU—299, pp 332) **Genetic pattern for the deposits of uranium-albitite formation.** Belevtsev, Ya.N.; Koval, V.B.; Stryghin, A.I. (AN Ukrainskoj SSR, Kiev. Inst. Geokhimii i Fiziki Mineralov). 1984. NTIS (US Sales Only), PC A17/MF A01. File Number DE85781599. (CONF-840820—Vol.9-Pt.1-Summs.).

From 27. international geological congress; Moscow, USSR (4 Aug 1984).

Short note.

46106 (INIS-SU—299, pp 334-335) **Mineralogy of uranium ores of the roll-front.** Belova, L.N.; Gorshkov, A.I.; Ivanova, O.A.; Sivtsov, A.V. (AN SSSR, Moscow. Inst. Geologii Rudnykh Mestorozhdenij, Petrografii, Mineralogii i Geokhimii). 1984. (In Russian). NTIS (US Sales Only), PC A17/MF A01. File Number DE85781599. (CONF-840820—Vol.9-Pt.1-Summs.).

From 27. international geological congress; Moscow, USSR (4 Aug 1984).

Short note.

46107 (INIS-SU—299, pp 335-336) **Manyingee uranium deposit, Western Australia.** Bout, J.P.; Lesavre, A. (Australian Mineral Industries Research Association Ltd., Parkville). 1984. NTIS (US Sales Only), PC A17/MF A01. File Number DE85781599. (CONF-840820—Vol.9-Pt.1-Summs.).

From 27. international geological congress; Moscow, USSR (4 Aug 1984).

Short note.

46108 (INIS-SU—299, pp 336) **Geologic environments for basal-type uranium deposits in sedimentary host rocks.** Boyle, D.R. (Geological Survey of Canada, Ottawa, Ontario). 1984. NTIS (US Sales Only), PC A17/MF A01. File Number DE85781599. (CONF-840820—Vol.9-Pt.1-Summs.).

From 27. international geological congress; Moscow, USSR (4 Aug 1984).

Short note.

46109 (INIS-SU—299, pp 336-337) **Surficial uranium deposits in Australia.** Butt, C.R.M. (Commonwealth Scientific and Industrial Research Organization, Floreat Park (Australia). Div. of Mineralogy). 1984. NTIS (US Sales Only), PC A17/MF A01. File Number DE85781599. (CONF-840820—Vol.9-Pt.1-Summs.).

From 27. international geological congress; Moscow, USSR (4 Aug 1984).

Short note.

46110 (INIS-SU—299, pp 338) **Geologic environment of the uranium deposits in the Carboniferous and Jurassic sandstones of the western margin of the air mountains in the republic of Niger.** Cazoulat, M. (Compagnie Generale des Matieres Nucleaires (COGEMA), Centre de la Hague, 50 - Cherbourg (France)). 1984. NTIS (US Sales Only), PC A17/MF A01. File Number DE85781599. (CONF-840820—Vol.9-Pt.1-Summs.).

From 27. international geological congress; Moscow, USSR (4 Aug 1984).

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46111 (INIS-SU—299, pp 340-341) **Main types of uranium deposits in Czech massif, Czechoslovakia.** Kominek, I.; Milovanov, I.A. (Ceskoslovensky Uranovy Prumysl, Pribram); Bojtsov, V.E. (Moskovskij Geologorazvedochnyj Inst. (USSR)); Galbrshtat, I. (Federalni Ministerstvo Paliv a Energetiky, Prague (Czechoslovakia)). 1984. (In Russian). NTIS (US Sales Only), PC A17/MF A01. File Number DE85781599. (CONF-840820—Vol.9-Pt.1-Summs.).

From 27. international geological congress; Moscow, USSR (4 Aug 1984).

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46112 (INIS-SU—299, pp 342) **Review concerning the origin of the Athabasca, Saskatchewan, Canada, uranium deposits.** Darnley, A.G. (Geological Survey of Canada, Ottawa, Ontario); Wallis, R.H. (Canadian Occidental Petroleum Ltd., Calgary, Alberta); Ruzicka, V. (Geological Survey of Canada, Ottawa, Ontario). 1984. NTIS (US Sales Only), PC A17/MF A01. File Number DE85781599. (CONF-840820—Vol.9-Pt.1-Summs.).

From 27. international geological congress; Moscow, USSR (4 Aug 1984).

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46113 (INIS-SU—299, pp 342-343) **Fault controlled uranium black ore mineralizations from the western edge of the Bohemian Massif (FR Germany NE Bavaria).** Dill, H.G. (Bundesanstalt fuer Geowissenschaften und Rohstoffe, Hannover (Germany, F.R.)). 1984. NTIS (US Sales Only), PC A17/MF A01. File Number DE85781599. (CONF-840820—Vol.9-Pt.1-Summs.).

From 27. international geological congress; Moscow, USSR (4 Aug 1984).

Short note.

46114 (INIS-SU—299, pp 343) **Genetic characteristics of the uranium deposit Zirovski vrh.** Dolenec, T.; Lukacs, E.; Pezdic, J. 1984. NTIS (US Sales Only), PC A17/MF A01. File Number DE85781599. (CONF-840820—Vol.9-Pt.1-Summs.).

From 27. international geological congress; Moscow, USSR (4 Aug 1984).

Short note.

46115 (INIS-SU—299, pp 344) **Uranium mineralization in relation to the alteration and sulfide parageneses in polymetallic zones of Iran.** Espahbod, M.R. (Atomic Energy Organization of Iran, Teheran). 1984. NTIS (US Sales Only), PC A17/MF A01. File Number DE85781599. (CONF-840820—Vol.9-Pt.1-Summs.).

From 27. international geological congress; Moscow, USSR (4 Aug 1984).

Short note.

46116 (INIS-SU—299, pp 344-345) **Salt plugs as a new uraniferous features in south eastern part of Zagros Belt, Iran.** Espahbod, M.R. (Atomic Energy Organization of Iran, Teheran). 1984. NTIS (US Sales Only), PC A17/MF A01. File Number DE85781599. (CONF-840820—Vol.9-Pt.1-Summs.).

From 27. international geological congress; Moscow, USSR (4 Aug 1984).

Short note.

46117 (INIS-SU—299, pp 346) **Alterations and structural setting of an uranium Proterozoic unconformity deposit: Cluff Lake D orebody (Saskatchewan - Canada).** Ey, F. (Institut de Geologie, Strasbourg (France)). 1984. NTIS (US Sales Only), PC A17/MF A01. File Number DE85781599. (CONF-840820—Vol.9-Pt.1-Summs.).

From 27. international geological congress; Moscow, USSR (4 Aug 1984).

Short note.

46118 (INIS-SU—299, pp 347) **Genesis of sandstone-type uranium deposit of Sierra Pintada District, Mendoza, Argentina.** Ferreyra, R.E.; Saulnier, M.E.; Vullien, A.R. (Comision Nacional de Energia Atomica, Buenos Aires (Argentina)). 1984. NTIS (US Sales Only), PC A17/MF A01. File Number DE85781599. (CONF-840820—Vol.9-Pt.1-Summs.).

From 27. international geological congress; Moscow, USSR (4 Aug 1984).

Short note.

46119 (INIS-SU—299, pp 348) **Summary of new developments in our understanding of sandstone-type uranium deposits.** Finch, W.I. (Geological Survey, Denver, CO (USA)). 1984. NTIS (US Sales Only), PC A17/MF A01. File Number DE85781599. (CONF-840820—Vol.9-Pt.1-Summs.).

From 27. international geological congress; Moscow, USSR (4 Aug 1984).

Short note.

46120 (INIS-SU—299, pp 348-349) **Glacial outwash uranium placers: evidence from the Lower Huronian Supergroup, Ontario, Canada.** Fralick, P.W. (Lakehead Univ., Thunder Bay, Ontario (Canada)); Miall, A.D. (Toronto Univ., Ontario (Canada). Dept. of Geology). 1984. NTIS (US Sales Only), PC A17/MF A01. File Number DE85781599. (CONF-840820—Vol.9-Pt.1-Summs.).

From 27. international geological congress; Moscow, USSR (4 Aug 1984).

Short note.

46121 (INIS-SU—299, pp 349) **General trends of uranium-bearing sandstone basins.** Fuchs, Y. (Uranium Pechiney Ugine Kuhlmann, 75 - Paris (France)). 1984. NTIS (US Sales Only), PC A17/MF A01. File Number DE85781599. (CONF-840820—Vol.9-Pt.1-Summs.).

From 27. international geological congress; Moscow, USSR (4 Aug 1984).

Short note.

46122 (INIS-SU—299, pp 350) **Vein-type uranium deposits in Yugoslavia.** Gertik, S.; Putnik, S.; Obrenovic, M.; Saric, V.; Gojkovic, S. (Geoinstitut, Beograd (Yugoslavia)). 1984. NTIS (US Sales Only), PC A17/MF A01. File Number DE85781599. (CONF-840820—Vol.9-Pt.1-Summs.).

From 27. international geological congress; Moscow, USSR (4 Aug 1984).

Short note.

46123 (INIS-SU—299, pp 351-352) **Organic material from the Cluff Lake (Canada) uranium district, its nature and paragenetic implications of the included mineral assemblages.** Grauch, R.I.; Leventhal, J.S. (Geological Survey, Denver, CO (USA)); Harper, C.T. (Saskatchewan Dept. of Mineral Resources, Regina (Canada)). 1984. NTIS (US Sales Only), PC A17/MF A01. File Number DE85781599. (CONF-840820—Vol.9-Pt.1-Summs.).

From 27. international geological congress; Moscow, USSR (4 Aug 1984).

Short note.

46124 (INIS-SU—299, pp 352) **Time-bound characteristics and tectonic control of Southern Africa's uranium deposits.** Hambleton-Jones, B.B.; Toens, P.D.; Levin, M. (Nuclear Development Corp. of South Africa (Pty.) Ltd., Pelindaba, Pretoria). 1984. NTIS (US Sales Only), PC A17/MF A01. File Number DE85781599. (CONF-840820—Vol.9-Pt.1-Summs.).

From 27. international geological congress; Moscow, USSR (4 Aug 1984).

Short note.

46125 (INIS-SU—299, pp 353) **Davidite veins of Radium Hill, South Australia.** Hiern, M.N. 1984. NTIS (US Sales Only), PC A17/MF A01. File Number DE85781599. (CONF-840820—Vol.9-Pt.1-Summs.).

From 27. international geological congress; Moscow, USSR (4 Aug 1984).

Short note.

46126 (INIS-SU—299, pp 354) **Diagenesis, clay mineral alteration and uranium metallogenesis in the Athabasca Basin, Northern Saskatchewan.** Hoeve, J.; Rawsthorn, K.; Quirt, D. (Saskatchewan Research Council, Saskatoon (Canada)). 1984. NTIS (US Sales Only), PC A17/MF A01. File Number DE85781599. (CONF-840820—Vol.9-Pt.1-Summs.).

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Short note.

46127 (INIS-SU—299, pp 356) **Tectonic and sedimentological environments of sandstone-hosted uranium deposits with special reference to the Karoo Basin of South Africa.** Le Roux, J.P. (Nuclear Development Corp. of South Africa (Pty.) Ltd., Pelindaba, Pretoria). 1984. NTIS (US Sales Only), PC A17/MF A01. File Number DE85781599. (CONF-840820—Vol.9-Pt.1-Summs.).

From 27. international geological congress; Moscow, USSR (4 Aug 1984).

Short note.

46128 (INIS-SU—299, pp 357) **Geologic environments of uranium deposits in quaternary volcano-sedimentary basins (Latium, Central Italy).** Locardi, E. (ENEA, Casaccia (Italy). Centro Ricerche Energia). 1984. NTIS (US Sales Only), PC A17/MF A01. File Number DE85781599. (CONF-840820—Vol.9-Pt.1-Summs.).

From 27. international geological congress; Moscow, USSR (4 Aug 1984).

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46129 (INIS-SU—299, pp 360-361) **Mineralogical and geochemical aspects of uranium albitite creation.** Mineeva, I.G. (Ministerstvo Geologii SSR, Moscow). 1984. (In Russian). NTIS (US Sales Only), PC A17/MF A01. File Number DE85781599. (CONF-840820—Vol.9-Pt.1-Summs.).

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Short note.

46130 (INIS-SU—299, pp 363) **Strata-bound uranium deposits in the Dripping Spring Quartzite, Gila County, Arizona, USA, a model for their formation.** Nutt, C.J. (Geological Survey, Denver, CO (USA)). 1984. NTIS (US Sales Only), PC A17/MF A01. File Number DE85781599. (CONF-840820—Vol.9-Pt.1-Summs.).

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Short note.

46131 (INIS-SU—299, pp 365-366) **Certain features of uranium mineralization in exogenetic deposits within Cenozoic rocks in Bulgaria.** Filipova, M.I.; Belova, L.N.; Stoeva, V.D.; Kharalampieva, K.N.; Dimova, I.M. (Ministerstvo Metallurgii i Mineral'nykh Resursov NRB (Bulgaria)). 1984. (In Russian). NTIS (US Sales Only), PC A17/MF A01. File Number DE85781599. (CONF-840820—Vol.9-Pt.1-Summs.).

From 27. international geological congress; Moscow, USSR (4 Aug 1984).

Short note.

46132 (INIS-SU—299, pp 366) **Sources of uranium in ore deposits.** Page, L.R. 1984. NTIS (US Sales Only), PC A17/MF A01. File Number DE85781599. (CONF-840820—Vol.9-Pt.1-Summs.).

From 27. international geological congress; Moscow, USSR (4 Aug 1984).

Short note.

46133 (INIS-SU—299, pp 366-367) **Mobilization and preservation of radioactive and rare-earth elements in Canadian vein-type and granite-hosted uranium deposits of Precambrian age.** Rimsaite, J. (Geological Survey of Canada, Ottawa, Ontario). 1984. NTIS (US Sales Only), PC A17/MF A01. File Number DE85781599. (CONF-840820—Vol.9-Pt.1-Summs.).

From 27. international geological congress; Moscow, USSR (4 Aug 1984).

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46134 (INIS-SU—299, pp 367-368) **Olympic Dam copper-uranium-gold deposit, Roxby Downs, South Australia.** Roberts, D.B.; Hudson, G.R.T. (Roxby Management Services Proprietary Ltd. (Australia)). 1984. NTIS (US Sales Only), PC A17/MF A01. File Number DE85781599. (CONF-840820—Vol.9-Pt.1-Summs.).

From 27. international geological congress; Moscow, USSR (4 Aug 1984).

Short note.

46135 (INIS-SU—299, pp 368-369) **Geologic environments of Ningyo-toge and Tono uranium deposits, Japan.** Sakamaki, Yu. (Geological Survey of Japan, Yatabe, Ibaraki (Japan)). 1984. NTIS (US Sales Only), PC A17/MF A01. File Number DE85781599. (CONF-840820—Vol.9-Pt.1-Summs.).

From 27. international geological congress; Moscow, USSR (4 Aug 1984).

Short note.

46136 (INIS-SU—299, pp 372) **Geology and genesis of uranium deposits of Czech chalky basin.** Shorf, F.; Vesely, T.; Kozurev, V.N. (Ceskoslovensky Uranovy Prumysl, Pribram). 1984. (In Russian). NTIS (US Sales Only), PC A17/MF A01. File Number DE85781599. (CONF-840820—Vol.9-Pt.1-Summs.).

From 27. international geological congress; Moscow, USSR (4 Aug 1984).

Short note.

46137 (INIS-SU—299, pp 376) **Radioactive element concentration processes in the earth's crust and uranium metallogeny problems.** Smyslov, A.A.; Terent'ev, V.M. (Vsesoyuznyj Nauchno-Issledovatel'skij Geologicheskij Inst., Leningrad (USSR)). 1984. (In Russian). NTIS (US Sales Only), PC A17/MF A01. File Number DE85781599. (CONF-840820—Vol.9-Pt.1-Summs.).

From 27. international geological congress; Moscow, USSR (4 Aug 1984).

Short note.

46138 (INIS-SU—299, pp 377) **World uranium resources: the known and the unknown.** Taylor, D.M. (International Energy Agency, 75 - Paris (France). Committee on the Safety of Nuclear Installations); Patterson, J.A. (International Atomic Energy Agency, Vienna (Austria)). 1984. NTIS (US Sales Only), PC A17/MF A01. File Number DE85781599. (CONF-840820—Vol.9-Pt.1-Summs.).

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Short note.

46139 (INIS-SU—299, pp 379-380) **Occurence of uranium bearing quartz-pebble conglomerates of Karnataka, India.** Viswanath, R.V.; Roy, M.K.; Vasudeva, S.G.; Aurora, S.N.; Phadke, A.V. (Department of Atomic Energy, Hyderabad (India). Atomic Minerals Div.). 1984. NTIS (US Sales Only), PC A17/MF A01. File Number DE85781599. (CONF-840820—Vol.9-Pt.1-Summs.).

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46140 (INIS-SU—299, pp 380-381) **Mineralization of breccia pipes in Northern Arizona.** Wenrich, K.J. (Geological Survey, Denver, CO (USA)). 1984. NTIS (US Sales Only), PC A17/MF A01. File Number DE85781599. (CONF-840820—Vol.9-Pt.1-Summs.).

From 27. international geological congress; Moscow, USSR (4 Aug 1984).

Short note.

46141 (INIS-SU—299, pp 381-382) **Sedimentary environments of the Late Sinian and Early Cambrian carbonaceous formation in South China and their relations with uranium mineralization.** Yijun, Ju (Inst. of Uranium Geology, Changsha (China)). 1984. NTIS (US Sales Only), PC A17/MF A01. File Number DE85781599. (CONF-840820—Vol.9-Pt.1-Summs.).

From 27. international geological congress; Moscow, USSR (4 Aug 1984).

Short note.

46142 (INIS-SU—299, pp 382) **Genesis of uranium deposits in neogene sedimentary rocks overlying the menderes metamorphic massif, Turkey.** Yilmaz, H. (Ege Universitesi, Izmir (Turkey)). 1984. NTIS (US Sales Only), PC A17/MF A01. File Number DE85781599. (CONF-840820—Vol.9-Pt.1-Summs.).

From 27. international geological congress; Moscow, USSR (4 Aug 1984).

Short note.

46143 (INIS-SU—299, pp 383) **Painter uranium deposit.** Youles, I. 1984. NTIS (US Sales Only), PC A17/MF A01. File Number DE85781599. (CONF-840820—Vol.9-Pt.1-Summs.).

From 27. international geological congress; Moscow, USSR (4 Aug 1984).

Short note.

46144 (INIS-SU—299, pp 384) **Genetic types of uranium-bearing granites and their related uranium deposits.** Zhang Zuhuan (Nanjing Univ. (China)). 1984. NTIS (US Sales Only), PC A17/MF A01. File Number DE85781599. (CONF-840820—Vol.9-Pt.1-Summs.).

From 27. international geological congress; Moscow, USSR (4 Aug 1984).

Short note.

46145 **(PAEC(A)IB—83008) Notes on the geochemical survey in Zamboanga del Norte - Misamis Occidental, Mindanao, Philippines.** Santos, G. Jr.; Seguis, J.E.; Carino, L.; Escalada, P.; Antonio, L. (Philippine Atomic Energy Commission, Diliman, Quezon City). Oct 1983. 7p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85702127.

Stream sediment and panned heavy mineral surveys were conducted in Zamboanga del Norte and Misamis Occidental provinces in northwestern Mindanao. A total of 70 stream sediments and 64 panned heavy mineral concentrates were obtained along active streams draining into the Mindanao sea. The minus 80 mesh sediment fractions were analyzed for total uranium using delayed neutron activation analysis techniques. Results indicated that uranium values ranged from 0.3 ppm to 2.4 ppm and 0.1 ppm to 1.1 ppm, for the stream sediments and heavy minerals respectively. These values were considered to be the range of the average concentrations present in the volcanic and marine sediments found in other parts of the country.(author).

46146 **(PAEC(B)IB—84001) Preliminary uranium geochemical survey of Pangasinan province, Luzon, Philippines.** Santos, G. Jr.; Magsambol, W.; Seguis, J.; Castillo, M.; Ortile, H.; Fernandez, L. (Philippine Atomic Energy Commission, Diliman, Quezon City). Jun 1984. 8p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85702128.

Sediment and panned heavy mineral survey were conducted in the province of Pangasinan in Luzon island for a cumulative period of 1 1/2 months in 1983. A total of 40 stream sediments and 125 panned heavy mineral concentrates were obtained along active rivers and streams draining into the Lingayen Gulf and Luzon sea. The minus 80 mesh sediment fractions and non-magnetic portions of the heavy minerals were analyzed for total uranium using delayed neutron activation analysis techniques. Results indicated that uranium values ranged from 0.1 ppm to 1.4 ppm and 0.1 ppm to 23.2 ppm, for the stream sediments and heavy minerals, respectively. The uranium values obtained in the stream sediments were considered to be within the range of the average uranium concentrations in the northwestern Luzon. However, uranium values in the heavy minerals, in general, were higher than the values obtained in northwestern Luzon. One uranium anomaly area was found in San Carlos.

46147 **(PAEC(C)IB—81002) Notes on the geochemical survey for uranium in Mindoro Island, Philippines.** Santos, G. Jr.; Fernandez, L.G.; Villamater, D.T.; Seguis, J.E.; Ibe, M.G.; Miranda, F.E.; Ronan, J.; Baura, C. Jr.; Crisologo, J. (Philippine Atomic Energy Commission, Diliman, Quezon City). Mar 1981. 26p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85702129.

Geochemical reconnaisance using stream sediment and heavy-mineral concentrates panned from coarse alluvium has been carried out in Mindoro Island, one of the oldest and diverse geologic terrains in the Philippines. A total of 135 selected sampling points situated near accessible areas along the periphery of the island were sampled. The samples were collected at a density of one sample per 53 sq. km. A set minus 80 mesh stream sediment fraction and heavy-mineral concentrates was obtained from each sampling point. Mobile or extractable and total uranium were determined. A large uranium anomaly was delineated over the Carboniferous Mindoro Metamorphics as well as in areas underlain by Early Tertiary sedimentary formations. Another group of anomalies were outlined in the southern part of the island underlain by Jurassic Mansalay Formation and Early to Middle Tertiary sedimentary rocks with associated limestone and coal measures.

46148 **(PAEC(C)IB—81011) Report on the radioactive mineral development project in Negros Island.** Santos, G. Jr.; Samonte, C.; Ranes, R.; Rovillos, P. Jr.; Salvado, J. (Philippine Atomic Energy Commission, Diliman, Quezon City). Dec 1981. 17p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85702130.

A reconnaissance radiometric and stream sediment survey was conducted in Negros Island from April to May 1980. An area in Mabinay, Negros Oriental with significant above-background uranium in stream sediment was delineated in Upper Miocene to Pliocene continental clastic associated with silty limestone. In general, Negros has low radioactivity except for isolated points which have 2-3 times above-the-background radioactivity. Other areas in the western part of the island with high radioactivity and above-normal uranium in stream sediments were delineated. However, these above-normal observations were noted in areas underlain by recent volcanic sediments which were probably derived from Mt. Kanlaon.

46149 **(PAEC(C)IB—82007) Uranium distribution in Northwestern Mindoro Island, Philippines.** Santos, G. Jr.; Seguis, J.E. (Philippine Atomic Energy Commission, Diliman, Quezon City). May 1982. 8p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85702131.

Uranium geochemical mapping based on stream sediment (-80 mesh size) employing delayed neutron activation analysis (DNAA) was tried in northwestern Mindoro Island. An automated analysis system was utilized to analyze for uranium by the neutron activation/delayed neutron counting technique. A total of 411 samples were analyzed. These samples were collected at a density of one sample per 2 sq. km. The background and threshold values were 2.4 ppm and 5 ppm uranium, respectively. Isolated anomaly points were delineated over Paleozoic (Carboniferous) Mindoro Metamorphics and Eocene Caaguray Formation.

46150 **(PAEC(C)IB—82008) Uranium distribution in Puerto Galera-San Teodoro, Northern Mindoro, Philippines.** Santos, G. Jr.; Seguis, J.E. (Philippine Atomic Energy Commission, Diliman, Quezon City). Sep 1982. 9p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85702132.

Geochemical mapping of uranium in stream sediment with the use of delayed neutron activation analysis (DNAA) was conducted in northeastern Mindoro Island. Uranium was determined in stream sediments by means of an automated analysis system utilizing a neutron activation/delayed neutron counting technique. Stream sediments were collected at a density of less than one sample per 2 sq. km. A total of 428 samples were analyzed. The background and threshold uranium values were 2.6 ppm and 4.5 ppm, respectively. Three small anomalous localities were identified in areas underlain by Paleozoic (Carboniferous) Mindoro Metamorphics (undifferentiated schist and marble). Further exploration of these anomalous areas is warranted.

## 0502 Exploration

*REFER ALSO TO CITATION(S) 46101, 46109*

46151 **(INIS-mf—9687) Semi-detailed uranium geochemical survey in Northwestern Samar (27 March 1979-4 July 1979).** Santos, G. Jr.; Ogena, M.; Tauli, G. (Philippine National Oil Co., Metro Manila. Uranium Div.). Apr 1980. 44p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85702124.

A uranium geochemical survey was conducted to delineate in detail the uranium prospective area(s) in northwestern Samar. A total of 805 stream sediments and 1.115 water samples were obtained from the target areas from uranium analysis. Geochemical anomalies were indicated in San Isidro and Mauo. Geochemical correlations between uranium and trace elements (Pb, Ag, Ni, Cu, Co, Zn and Mn) were generally poor.

46152 **(INIS-mf—9688) Uranium geochemical exploration in northwestern Luzon.** Santos, G. Jr.; Fernandez, L.; Ogena, M.; Tauli, G. (Philippine National Oil Co., Metro Manila. Uranium Div.). 1980. 17p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85702125.

Maps in separate cover.

A reconnaissance geochemical stream water and sediment survey which was conducted in northwestern Luzon was able to detect ten uranium anomalous areas. These anomalous areas are located along a north-south trending zone of Miocene marine clastics and sedimentary rocks with tuffaceous sediment intercalations. In general, northwest Luzon has low radioactivity except for two anomalous areas which have 3 to 6 times background radioactivity. Radon anomalies occur in sparsely scattered locations. The anomalous zones appear to be related to major north-south faults and secondary northeast-southwest trending structures. Geochemical correlations between uranium and other elements such as copper, lead, zinc, manganese, silver, cobalt and nickel are generally very poor.

46153 (INIS-SU—299, pp 339-340) **Structural control of uranium mineralization in the Oberpfalz area, North-Eastern Bavaria, Federal Republic of Germany.** Clasen, D.; Kuhlmann, J. (Saarberg-Hoelter Umwelttechnik G.m.b.H., Saarbruecken (Germany, F.R.)). 1984. NTIS (US Sales Only), PC A17/MF A01. File Number DE85781599. (CONF-840820—Vol.9-Pt.1-Summs.).

From 27. international geological congress; Moscow, USSR (4 Aug 1984).

Short note.

46154 (INIS-SU—299, pp 346-347) **Uranium exploration in SRI LANKA.** Ferando, M.R.D. (Geological Survey Department, Colombo (Sri Lanka)). 1984. NTIS (US Sales Only), PC A17/MF A01. File Number DE85781599. (CONF-840820—Vol.9-Pt.1-Summs.).

From 27. international geological congress; Moscow, USSR (4 Aug 1984).

Short note.

46155 (INIS-SU—299, pp 355-356) **Uranium ore deposits in South Korea.** Kim Jong Dae (Inst. Of Energy and Resources, Seoul (South Korea)). 1984. NTIS (US Sales Only), PC A17/MF A01. File Number DE85781599. (CONF-840820—Vol.9-Pt.1-Summs.).

From 27. international geological congress; Moscow, USSR (4 Aug 1984).

Short note.

46156 (PAEC(A)IB—83007) **Reconnaisance geochemical survey of heavy minerals in Northern Luzon, Philippines.** Santos, G. Jr.; Seguis, J.E.; Fernandez, L.G.; Miranda, F.E.; Custodio, D.G.; Alfaro, N.P. (Philippine Atomic Energy Commission, Diliman, Quezon City). Jul 1983. 32p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85702126.

A reconnaissance sampling was undertaken in northern Luzon to study the distribution of uranium as well as copper, lead, zinc, manganese, silver, cobalt and nickel in heavy minerals. The average background and threshold values of the elements were determined. Uranium content in the heavy mineral was low, in the order of 0.5-0.6 ppm U. Three uranium anomaly zones were delineated in Malanas Rever-Licuan area, Abra, Itogon, Benguet and Bambang, Nueva Viscaya, all within the Central Cordillera. The anomalous zones appeared to be related to copper-gold mineral areas. Geochemical correlations between uranium and the other elements were generally poor.

46157 (PAEC(C)IB—82010) **Radon survey (track etch) for uranium in Tamdagan, Vintar, Ilocos Norte, Luzon.** Santos, G. Jr.; Rondan, G. (Philippine Atomic Energy Commission, Diliman, Quezon City). Nov 1982. 10p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85702133.

A radon (track etch) for uranium was carried out in Tamdagan, Vintar, Ilocos Norte, in northern Luzon to delineate possible exploratory drilling targets. A square grid was established at 200-meter intervals in Battut River area in Tamdagan. Shallow holes about 75 cm. deep and 13-14 cm. in diameter were made. The track etch cups were placed in the holes for 30 days and later sent to Terradex Corporation of California for processing. The results outlined at least one radon geochemical anomaly which was considered a worthwhile target for exploratory drilling in the search for blind uranium deposits.

46158 (PAEC(C)IC—82001) **Notes on the radiometric and geochemical survey of Leyte Island.** Santos, G. Jr.; Samonte, C.; Almeda, R.; Ranes, R.; Salvado, J.; Rovillas, P. Jr. (Philippine Atomic Energy Commission, Diliman, Quezon City). Jan 1982. 9p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85702134.

Radioactivity measurements using the Scintrex GIS-4 portable scintillometer were conducted along the periphery of the island. These radiometric readings as well as sediments were obtained along the streams draining into the sea. A total of 174 stream sediments samples were collected. Minus 80 mesh sediment fraction was analyzed for mobile or extractable uranium. Results indicated that the background values of radioactivity and uranium in stream sediments were 25 counts per second (cps) and 0.3 ppm, respectively. The San Isidro and Vilaba areas which are located in the northern part of Leyte have greater than 3 times above background radioactivity and uranium in the stream sediments.

## 0504 Feed Processing

*REFER ALSO TO CITATION(S) 46215, 46229*

## 0505 Enrichment

46159 (CEA-CONF—7727) **Present and prospective situation in laser isotope separation: will the free electron laser be needed.** Rigny, P. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Sep 1984. 22p. (CONF-8409144—8). NTIS (US Sales Only), PC A02/MF A01. File Number DE85752179.

From Free electron laser conference; Castelgandolfo, Italy (3 Sep 1984).

The need for enriched isotopes, as it appears to day will be recalled for the foreseeable future, this need, in quantitative terms, will be confined to isotopes for nuclear energy. The interest of laser isotope separation will finally depend on our ability to fulfil a number of requirements as to the laser output light characteristics. These will be recalled for the most common laser processes (molecular photodissociation and atomic photoionisation). At this point a comparison with expectations from the FEL can already be attempted. Less common laser isotope separation schemes can gain interest from the possibilities opened by the FEL, especially by access to new wavelengths ranges. Some schemes implying UV or VUV photons will be discussed, as well as some possibilities involving IR photons. Attention will be paid to the problems that arise when considering scaled-up isotope separation installations. A large scale process results in more constraints on the laser parameters. Estimation of FEL capacity in this respect will be attempted.

## 0506 By-products

46160 (PNL-SA—12972) **Platinum-group metals from nuclear reactions as a possible resource.** Jensen, G.A. (Pacific Northwest Labs., Richland, WA (USA)). Mar 1985. Contract AC06-76RL01830. 21p. (CONF-8506176—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85016277.

From International Precious Metals Institute conference and exhibit; New York, NY, USA (10 Jun 1985).

Spent nuclear fuels contain significant quantities of three of the platinum-group metals (ruthenium, rhodium, and palladium), and a related element technetium, which is nearly absent in nature. Applications for ruthenium, rhodium, and palladium are well established. Since the supply of these and other platinum metals is largely from foreign sources, they are considered strategic materials. Existing and future spent nuclear fuels contain quantities of these platinum metals that exceed the United States reserve base. Technetium has properties similar to platinum metals and has unique, useful properties of its own. The technical feasibility of recovering and using fission product platinum metals (and technetium) extensively in industry depends on: thoroughly decontaminating platinum-group metals from all other radioactive materials in the waste stream; separating platinum-group metals from one another in very high purity; using applications where appropriate control of the residual radioactivity is possible; and whether or not the United States will recover or process spent fuel prior to repository storage. If the radioactivity must be removed, isotope separation or long term storage to allow decay of the contained radioisotopes may be possible. 7 figs., 7 tabs.

## 0507 Fuels Production And Properties

*REFER ALSO TO CITATION(S) 46230, 46471*

**46161 Preparation of nuclear fuel spheres by flotation-internal gelation.** Haas, P.A.; Fowler, V.L.; Lloyd, M.H. (to Department of Energy). US Patent Application 6-685,013. 21 Dec 1984. 24p. Contract AC05-84OR21400. DE85017739 NTIS, PC A02/MF A01; GPO Dep. File Number DE85017739.

A simplified internal gelation process is claimed for the preparation of gel spheres of nuclear fuels. The process utilizes perchloroethylene as a gelation medium. Gelation is accomplished by directing droplets of a nuclear fuel broth into a moving volume of hot perchloroethylene (about 85°C) in a trough. Gelation takes place as the droplets float on the surface of the perchloroethylene and the resultant gel spheres are carried directly into an ager column which is attached to the trough. The aged spheres are disengaged from the perchloroethylene on a moving screen and are deposited in an aqueous wash column. 3 figs.

**46162 Dump assembly.** Goldmann, L.H. (to Department of Energy). US Patent Application 6-678,913. 6 Dec 1984. 20p. Contract AC06-76FF02170. DE85017734 NTIS, PC A02/MF A01; GPO Dep. File Number DE85017734.

This is a claim for a dump assembly having a fixed conduit and a rotatable conduit provided with overlapping plates, respectively, at their adjacent ends. The plates are formed with openings, respectively, normally offset from each other to block flow. The other end of the rotatable conduit is provided with means for securing the open end of a filled container thereto. Rotation of the rotatable conduit raises and inverts the container to empty the contents while concurrently aligning the conduit openings to permit flow of material therethrough. 4 figs.

## 0508 Spent Fuels Reprocessing

*REFER ALSO TO CITATION(S) 46160, 46187, 46430, 46867*

**46163 (CONF-850610—47) SAF-BRET-FMEF: a developmental LMR fuel cycle facility.** Stradley, J.G.; Yook, H.R.; Gerber, E.W.; Lerch, R.E.; Rice, L.H. (Oak Ridge National Lab., TN (USA); Hanford Engineering Development Lab., Richland, WA (USA)). 1985. Contract AC05-84OR21400. 33p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85016366.

From Annual meeting of the American Nuclear Society; Boston, MA, USA (9 Jun 1985).

The SAF-BRET-FMEF complex represents a versatile fuel cycle facility for processing LMR fuel. While originally conceived for processing FFTF and CRBRP fuel, it represents a facility where LMR fuel from the first generation of innovative LMRs could be processed. The cost of transporting fuel from the LMR to the Hanford site would have to be assessed when the LMR site is identified. The throughput of BRET was set at 15 MTHM/yr during conceptual design of the facility, a rate which was adequate to process all of the fuel from FFTF and fuel and blanket material from CRBRP. The design is currently being reevaluated to see if BRET could be expanded to ~35 MTHM/yr to process fuel and blanket material from ~1300 MWe generating capacity of the innovative LMRs. This expanded throughput is possible by designing the equipment for an instantaneous throughput of 0.2 MTHM/d, and by selected additional modifications to the facility (e.g., expansion of shipping and receiving area, and addition of a second entry tunnel transporter), and by the fact that the LMR fuel assemblies contain more fuel than the FFTF assemblies (therefore, fewer assemblies must be handled for the same throughput). The estimated cost of such an expansion is also being assessed. As stated previously, the throughput of SAF and Fuel Assembly could be made to support typical LMRs at little additional cost. The throughput could be increased to support the fuel fabrication requirements for 1300 MWe generating capacity of the innovative LMRs. This added capacity may be achieved by increasing the number of operating shifts, and is affected by variables such as fuel design, fuel enrichment, and plutonium isotopic composition.

**46164 (MLM—3289(OP)) Sampling and data-taking strategies in x-ray fluorescence assay of low S/N solutions.** Hudgens, C.R. (Monsanto Research Corp., Miamisburg, OH (USA). Mound). 1985. Contract AC04-76DP00053. 8p. (CONF-8508118—2). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85017423.

From 34. Denver X-ray conference; Denver, CO, USA (1 Aug 1985).

This projet was initiated for the purpose of demonstrating the feasibility of on-line x-ray fluorescence (XRF) analysis for the nondestructive assay of fissile elements (SNM) in reactor fuel reprocessing (dissolver) solutions, using wavelength dispersive x-ray fluorescence analysis because of its high immunity to the intense gamma emissions of the solutions. A prime objective of this project was the identification and dimensioning of the parameters critical to XRF assays of high accuracy. The concepts presented herein, though directed primarily to assay of solutions with emphasis on low signal-to-noise conditions and low count rates, are applicable to all assays of solids, slurries, and gases. This study shows that for solution analysis "total sampling" gives total mass assays with no need for solution density or tank volume measurements. Time savings and standard deviations are both benefited by systematically predetermining the count requirements of analyts, standards, and backgrounds by the use of equations based on propagation of error considerations. This becomes quite important when assaying dilute solutions, in which the signal-to-noise ratios of the x-ray intensities are very low. When counting times are long, short dwell times at each spectrometer setting significantly counteract error accumulation arising from long-term instrumental drift. 8 refs.

**46165 (ORNL/TM—9633) IET tank calibration study.** Hebble, T.L.; Wachter, J.W.; Kerr, H.T. (Oak Ridge National Lab., TN (USA)). Aug 1985. Contract AC05-84OR21400. 23p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85018157.

This report documents relevant considerations and results from volume calibration studies on eight process tanks in the Integrated Equipment Test (IET) facility. Accurate calibration data for these tanks are an important part of the data base required for meaningful demonstrations of advanced methods for safeguarding nuclear materials in the reprocessing plants. Some factors that influence tank calibrations are identified, and a procedure is described for performing calibrations suitable for safeguards purposes. The calibration equations and associated statistics for the eight IET tanks are presented. 2 refs., 11 figs., 3 tabs.

**46166 (RFP—3824) Recent chemical research projects in pyrochemistry.** Long, J.L. (Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant). 29 Apr 1985. Contract AC04-76DP03533. 19p. (CONF-8505139—6). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85013215.

From 9. annual actinide separations workshop; Richland, WA, USA (22 May 1985).

The purpose is to create, define parametric limits for, and transfer to the Pyrochemical Development group a pyrochemical (electrochemical) process for the recovery of spent anodes from plutonium electrorefining. The basis for this endeavor is the idea of modifying the character of spent anodes to obtain and maintain a liquid state during continued electrolytic depletion of plutonium. There are many alloying agents or combinations of alloying agents which could be added. The one chosen for the initial work was gallium because of its low melting point and low vapor pressure. From the Pu-Ga phase diagram, a composition of approximately 78 atomic percent gallium (50 weight percent) was chosen for the first solubilization experiment. One hundred grams each of spent anode and gallium were heated under 490 grams of NaCl-KCl-$MGCl_2$ to 740 C, held for one hour and stirred for one hour. Examination of the microstructure of the resultant cooled mixture indicated that 90% of the surface was a single phase containing near-equal concentrations of plutonium and gallium. The microstructure also contained inclusions of various impurities. The probability of anodically depleting the mixture of plutonium and gallium down to a very low level is high, based upon the electro-chemical potentials for plutonium and gallium in chloride systems. This work has the potential to provide a single step process for the removal of plutonium from spent anodes to the level where the remaining Ga-rich

material can be discarded. Reuse of the Ga-rich material is also a possibility. The plutonium should be recoverable as a metal phase.

46167 **Electrolysis cell for reprocessing plutonium reactor fuel.** Miller, W.E.; Steindler, M.J.; Burris, L. (to Dept. of Energy). US Patent Application 6-688,669. 4 Jan 1985. 9p. Contract W-31-109-ENG-38. DE85017744 NTIS, PC A02/MF A01; GPO Dep. File Number DE85017744.

An electrolytic cell for refining a mixture of metals including spent fuel containing U and Pu contaminated with other metals is claimed. The cell includes a metallic pot containing a metallic pool as one anode at a lower level, a fused salt as the electrolyte at an intermediate level and a cathode and an anode basket in spaced-apart positions in the electrolyte with the cathode and anode being retractable to positions above the electrolyte during which spent fuel may be added to the anode basket. The anode basket is extendable into the lower pool to dissolve at least some metallic contaminants; the anode basket contains the spent fuel acting as a second anode when in the electrolyte.

## 0509 Transport And Storage

*REFER ALSO TO CITATION(S) 46175, 46236, 46924, 46926, 47871*

46168 **(SAND—84-2645) Fraction of waste contents released from 55-gallon drums to the TRUPACT-I cavity during Type B package testing.** Sandoval, R.P.; Apple, M.A.; Grandjean, N.R. (Sandia National Labs., Albuquerque, NM (USA)). May 1985. Contract AC04-76DP00789. 106p. (TTC—0537). NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE85016197.

A series of full-scale experiments were conducted to characterize the release of simulated waste from waste containers packaged in a Transuranic Package Transporter (TRUPACT-I) which was subjected to a series of drop, puncture, and thermal tests. Powder tracers were mixed with the simulated waste to facilitate measurement of waste materials released to the cavity of TRUPACT-I. Data are presented on damage to secondary waste containers and on fraction released and size distribution of released material. 8 refs., 22 figs., 12 tabs.

46169 **(UCRL—53637) Instrumentation Report No. 3: performance and reliability of instrumentation deployed for the Spent Fuel Test - Climax.** Patrick, W.C.; Rector, N.L.; Scarafiotti, J.J. (Lawrence Livermore National Lab., CA (USA)). Dec 1984. Contract W-7405-ENG-48. 79p. NTIS, PC A05/MF A01; GPO Dep. File Number DE85017143.

A demonstration of the short-term storage and subsequent retrieval of spent nuclear fuel assemblies was successfully completed at the US Department of Energy's Nevada Test Site. Nearly 1000 instruments were deployed to monitor the temperature of rock, air, and metallic components of the test; displacements and stress changes within the rock mass; radiation dosage to personnel and to the rock; thermal energy input; characteristics of the ventilation airstream; and the operational status of the test. Careful selection, installation, calibration, and maintenance of these instruments ensured the acquisition of about 15.3 x $10^6$ high-quality data points. With few exceptions, the performance and reliability of the instrumentation and associated data acquisition system (DAS) were within specified acceptable limits. Details of the performance and reliability of the instrumentation are discussed in this report. 42 figs., 32 tabs.

## 0510 Marketing And Economics

*REFER ALSO TO CITATION(S) 46192*

## 0520 Waste Management

*REFER ALSO TO CITATION(S) 46208, 46209, 46210, 46211, 46214, 46216, 46217, 46218, 46220, 46226, 46558, 46739, 46867, 47288, 47457, 47458, 47463*

46170 **(ANL/ES—147) Radioactive waste isolation in salt: rationale and methodology for Argonne-conducted reviews of site characterization programs.** Harrison, W.; Ditmars, J.D.; Tisue, M.W.; Hambley, D.F.; Fenster, D.F.; Rote, D.M. (Argonne National Lab., IL (USA)). Jul 1985. Contract W-31-109-ENG-38. 55p. NTIS, PC A04/MF A01; GPO Dep. File Number DE85018006.

Both regulatory and technical concerns must be addressed in Argonne-conducted peer reviews of site characterization programs for individual sites for a high-level radioactive waste repository in salt. This report describes the regulatory framework within which reviews must be conducted and presents background information on the structure and purpose of site characterization programs as found in US Nuclear Regulatory Commission (NRC) Regulatory Guide 4.17 and Title 10, Part 60, of the Code of Federal Regulations. It also presents a methodology to assist reviewers in addressing technical concerns relating to their respective areas of expertise. The methodology concentrates on elements of prime importance to the US Department of Energy's advocacy of a given salt repository system during the NRC licensing process. Instructions are given for reviewing 12 site characterization program elements, starting with performance objectives, performance issues, and levels of performance of repository subsystem components; progressing through performance assessment; and ending with plans for data acquisition and evaluation. The success of a site characterization program in resolving repository performance issues will be determined by judging the likelihood that the proposed data acquisition activities will reduce uncertainties in the performance predictions. 8 refs., 3 figs., 5 tabs.

46171 **(CEA-CONF—7731) Ceramics and glasses for radioactive waste storage.** Baudin, G. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France)). Jun 1984. 18p. (In French). (CONF-8406260—1). NTIS (US Sales Only), PC A02/MF A01. File Number DE85752178.

From 27. colloquium on metallurgy; Saclay, France (18 Jun 1984).

Borosilicate glasses are mainly choosen for the confinement of fission products; industrial plants are either in operation (AVM) or in construction. Studies of ceramics as a matrix haven't received real application.

46172 **(CONF-850918—6) Automated sensitivity analysis of the radionuclide migration code UCBNE10.2.** Pin, F.G.; Worley, B.A.; Oblow, E.M.; Wright, R.Q.; Harper, W.V. (Oak Ridge National Lab., TN (USA); Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation). 1985. Contract AC05-84OR21400. 16p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85017080.

From International topical meeting on high level nuclear waste disposal - technology and engineering; Pasco, WA, USA (24 Sep 1985).

The Salt Repository Project (SRP) of the US Department of Energy is performing ongoing performance assessment analyses for the eventual licensing of an underground high-level nuclear waste repository in salt. As part of these studies, sensitivity and uncertainty analysis play a major role in the identification of important parameters, and in the identification of specific data needs for site characterization. Oak Ridge National Laboratory has supported the SRP in this effort resulting in the development of an automated procedure for performing large-scale sensitivity analysis using computer calculus. GRESS, Gradient Enhanced Software System, is a pre-compiler that can process FORTRAN computer codes and add derivative taking capabilities to the normal calculated results. The GRESS code is described and applied to the code UCB-NE-10.2

which simulates the migration through an adsorptive medium of the radionuclide members of a decay chain. Conclusions are drawn relative to the applicability of GRESS for more general large-scale modeling sensitivity studies, and the role of such techniques in the overall SRP sensitivity/uncertainty program is detailed. 6 refs., 2 figs., 3 tabs.

46173 **(DOE/CH—10140-3(85-1)) Salt Repository Project. Technical progress report for the quarter, 1 October-31 December 1984.** (Battelle Memorial Inst., Columbus, OH (USA). Office of Nuclear Waste Isolation). 1985. Contract AC02-83CH10139. 105p. NTIS, PC A06/MF A01; GPO Dep. File Number DE85017696.

This document reports the progress being made each quarter on the development of a geologic repository in salt for the permanent disposal of high-level nuclear waste. The reporting elements are arranged by the work breakdown structure so that related studies are presented together. The studies are reported by the Office of Nuclear Waste Isolation, a prime contractor of the US Department of Energy (DOE) Salt Repository Project Office. The studies include work by other DOE prime contractors and by contractors to the Office of Nuclear Waste Isolation. 3 figs.

46174 **(DOE/ID/01570—T99) Radioactive solid waste inventories at United States Department of Energy burial and storage sites.** Watanabe, T. (EG and G Idaho, Inc., Idaho Falls (USA)). Jun 1985. Contract AC07-76ID01570. 83p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE85017479.

Radioactive solid waste inventories are given for United States Department of Energy (DOE) burial and storage sites. These data are obtained from the Solid Waste Information Management System (SWIMS) and reflect the inventories as of the end of the calendar year 1984. This report differs from previous issues in that the data cutoff date is December 31, 1984, rather than the fiscal year end. Another difference from previous issues is that data for the TRU categories 1 and 6 have been omitted. 4 figs., 7 tabs.

46175 **(DOE/NV/10250—21) Commercial Nuclear Waste Research and Development Program. Quarterly report, April-June 1985.** (Westinghouse Electric Corp., Mercury, NV (USA). Waste Technology Services Div.). Jul 1985. Contract AC08-82NV10250. 30p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85017343.

Support was provided to DOE/NV during preparation of a proposal, requested by the DOE San Francisco office, for performance of SP-100 Ground Engineering Systems tests at the E-MAD facility. The site selection committee visited the Nevada Test Site in May for a tour and briefings on all aspects of the proposal. The fuel assembly used in the two-year metal cask simulation test was removed from the test stand and characterized to document its post-test condition. Fuel assembly integrity monitoring for the second half of FY 1985 was completed of six of the fuel assemblies being stored in unwelded canisters. Post-storage characterization was completed on three fuel assemblies which were stored in welded canisters. All test procedures have been completed and delivered for the Canister Assembly Launch Test Program being conducted at another Area 25 facility. The "Safety Assessment Document for Spent Fuel Handling, Packaging, and Storage Demonstrations at the E-MAD Facility on the Nevada Test Site," DOE/NV10250-20, was revised to be consistent with new and revised DOE Orders and Directives, and delivered to DOE/NV.

46176 **(DP-MS—85-13) Effects of waste content of glass waste forms on Savannah River high-level waste disposal costs.** McDonell, W.R.; Jantzen, C.M. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). 1985. Contract AC09-76SR00001. 24p. (CONF-850918—5). NTIS, PC A02/MF A01; GPO Dep. File Number DE85016452.

From International topical meeting on high level nuclear waste disposal - technology and engineering; Pasco, WA, USA (24 Sep 1985).

Effects of the waste content of glass waste forms of Savannah River high-level waste disposal costs are evaluated by their impact on the number of waste canisters produced. Changes in waste content affect onsite Defense Waste Processing Facility (DWPF) costs as well as offsite shipping and repository emplacement charges. A nominal 1% increase over the 28 wt % waste loading of DWPF glass would reduce disposal costs by about $50 million for Savannah River wastes generated to the year 2000. Waste form modifications under current study include adjustments of glass frit content to compensate for added salt decontamination residues and increased sludge loadings in the DWPF glass. Projected cost reductions demonstrate significant incentives for continued optimization of the glass waste loadings. 13 refs., 3 figs., 3 tabs.

46177 **(DP-MS—85-16A) Redox control of electric melters with complex feed compositions. Part I: analytical methods and models.** Bickford, D.F.; Diemer, R.B. Jr. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.; Du Pont de Nemours (E.I.) and Co., Wilmington, DE (USA). Engineering Dept.). 1985. Contract AC09-76SR00001. 17p. (CONF-850755—3). NTIS, PC A02/MF A01; GPO Dep. File Number DE85016453.

From Symposium on physics and chemistry of glass and glassmaking; Alfred, NY, USA (30 Jul 1985).

The redox state of glass from electric melters with complex feed compositions is determined by balance between gases above the melt, and transition metals and organic compounds in the feed. Part I discusses experimental and computational methods of relating flowrates and other melter operating conditions to the redox state of glass, and composition of the melter offgas. Computerized thermodynamic computational methods are useful in predicting the sequence and products of redox reactions and in assessing individual process variations. Melter redox state can be predicted by combining monitoring of melter operating conditions, redox measurement of fused melter feed samples, and periodic redox measurement of product. Mossbauer spectroscopy, and other methods which measure Fe(II)/Fe(III) in glass, can be used to measure melter redox state. Part II develops preliminary operating limits for the vitrification of High-Level Radioactive Waste. Limits on reducing potential to preclude the accumulation of combustible gases, accumulation of sulfides and selenides, and degradation of melter components are the most critical. Problems associated with excessively oxidizing conditions, such as glass foaming and potential ruthenium volatility, are controlled when sufficient formic acid is added to adjust melter feed rheology.

46178 **(DP-MS—85-16B) Redox control of electric melters with complex feed compositions. Part II: preliminary limits for radioactive waste melters.** Bickford, D.F.; Diemer, R.B. Jr.; Iverson, D.C. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.; Du Pont de Nemours (E.I.) and Co., Wilmington, DE (USA). Engineering Dept.). 1985. Contract AC09-76SR00001. 28p. (CONF-850755—4). NTIS, PC A03/MF A01; GPO Dep. File Number DE85017059.

From Symposium on physics and chemistry of glass and glassmaking; Alfred, NY, USA (30 Jul 1985).

Melter redox control is necessary for safe and continued melter operation. A combination of feed composition control, melter operational controls and monitors, and periodic determination of product glass redox state is sufficient to meet operating and safety requirements. Mossbauer spectroscopy, or other methods which determine the Fe(II)/Fe(III) ratio of the glass product, can be used to determine the oxidation state of the glass and thereby assess operating conditions. Slightly reducing conditions can eliminate radio-Ru volatility by suppressing the formation of RuO4. Reducing conditions also limit foaming resulting from the release of oxygen as transition metal oxides are dissolved in the melt. The calcination and partial combustion of organic compounds in the melter feed generates combustible mixtures of CO, H2 and benzene. The organics must be essentially completely incinerated to avoid the accumulation of combustible offgas mixtures, and prevent fouling of the equipment by soot and tars. Operation of the melter plenum above the autoignition temperature, metering in of purge air in excess of that required for complete combustion, and dilution by water vapor from reacted feed all preclude this occurrence in the melter. Prevention of dangerous offgas compositions after water vapor removal is assured by combustion in the melter, the addition of dilution air, and by continuous monitoring by % Lower Explo-

sive Limit meters. Melter reducing power must be restricted to prevent formation of molten sulfides or selenides in the melter, and to prevent carburization and sulfidation attack of Inconel-690 melter components. Control of average oxygen partial pressure in the melter plenum is insufficient to assure prevention of localized attack of Inconel-690. An additional requirement is therefore necessary, that no soot or tarry substances be deposited on the Inconel-690.

46179 **(EEG—29) Evaluation of the Safety Analysis Report for the Waste Isolation Pilot Plant Project.** Little, M.S. (New Mexico Health and Environment Dept., Santa Fe (USA). Environmental Evaluation Group). May 1985. Contract AC04-78AL10752. 61p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85016422.

The Safety Analysis Report (SAR) for the Waste Isolation Pilot Plant (WIPP) Project was first published by the US Department of Energy (DOE), WIPP Project Office (WPO) in 1980. Since that time a total of eight amendments to this Report have been published. As part of its independent evaluation of the WIPP Project for the State of New Mexico, the Environmental Evaluation Group (EEG) maintains a continuing technical assessment of the information in this Report and its amendments. Beginning with the initial publication, and following the amendments, the EEG prepares detailed written comments and recommendations which are submitted to the WPO for consideration in future amendments. The WPO has made many substantial changes to the SAR in response to the EEG's comments. On frequent occasions, meetings between the two groups have been held in an effort to reach an accord on some of the more controversial issues. These meetings generally have been very constructive, but several important areas of conflict remain. In many instances, these areas represent changes which are to be considered by the WPO at some future date, rather than irreconcilable issues. The most important issues remaining to be resolved are included in the discussions of this report, and could be summarized as follows: (1) An amendment of the topical content to be more in accord with the DOE Order 5481.1A and AL 5481.1A. (2) Substantial revisions of the classification of components, structures and systems, and related quality assurance. (3) Revisions to the site geological and hydrologic data based on studies agreed to between DOE and the State.

46180 **(EEG—30) Evaluation of the Waste Isolation Pilot Plant classification of systems, structures and components.** (Tenera Corp., Berkeley, CA (USA)). Jul 1985. Contract AC04-78AL10752. 64p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85016423.

A review of the classification system for systems, structures, and components at the Waste Isolation Pilot Plant (WIPP) was performed using the WIPP Safety Analysis Report (SAR) and Bechtel document D-76-D-03 as primary source documents. The regulations of the US Nuclear Regulatory Commission (NRC) covering "Disposal of High level Radioactive Wastes in Geologic Repositories," 10 CFR 60, and the regulations relevant to nuclear power plant siting and construction (10 CFR 50, 51, 100) were used as standards to evaluate the WIPP design classification system, although it is recognized that the US Department of Energy (DOE) is not required to comply with these NRC regulations in the design and construction of WIPP. The DOE General Design Criteria Manual (DOE Order 6430.1) and the Safety Analysis and Review System for AL Operation document (AL 54f81.1A) were reviewed in part. This report includes a discussion of the historical basis for nuclear power plant requirements, a review of WIPP and nuclear power plant classification bases, and a comparison of the codes and standards applicable to each quality level. Observations made during the review of the WIPP SAR are noted in the text of this reoport. The conclusions reached by this review are: WIPP classification methodology is comparable to corresponding nuclear power procedures. The classification levels assigned to WIPP systems are qualitatively the same as those assigned to nuclear power plant systems.

46181 **(EEG—31) Chemistry of Rustler fluids.** Ramey, D.S. (New Mexico Health and Environment Dept., Santa Fe (USA). Environmental Evaluation Group). Jul 1985. Contract AC04-78AL10752. 64p. NTIS MF A01; 2; GPO Dep. File Number DE85016424.

Water chemistry determinations were performed by the US Geological Survey on water samples collected from the three fluid-bearing zones of the Rustler Formation from 20 testholes at and adjacent to the WIPP from 1976 to 1980. Analysis of the data demonstration that the three fluid-bearing zones are chemically separate from one another at the WIPP site, but progressively merge towards the west into Nash Draw. The fluids present at the Rustler-Salado contact approach saturation with respect to sodium chloride. Magnesium replaces sodium as the prevalent cation east of the WIPP site: this boundary may represent the approximate limit of salt dissolution in the Rustler Formation. Three zones (areally) of differing predominant chemical constituents are present in the Culebra Dolomite. Groundwater flow paths cross these zones, changing the Culebra water from a sodium choride brine to a moderately saline calcium sulfate water. The Culebra waters are undersaturated with respect to halite and have the capacity of dissolving more halite from the Rustler or the Salado formations. The major ions present in the fluids in the Magenta Dolomite are predominantly sodium and chloride. A few wells have sulfate rather than chloride as the predominant anion.

46182 **(EGG-WM-F—1-81-024) Conceptual design report for waste incineration development activity. Internal technical report.** Logan, J.A.; Maughan, R.Y.; Withers, S.R. (EG and G Idaho, Inc., Idaho Falls (USA)). Nov 1981. Contract AC07-76ID01570. 141p. NTIS, PC A07/MF A01; 1; GPO Dep. File Number DE85017234.

This project consists of establishing the Waste Incineration Development Activity (WIDA) in the Waste Experimental Reduction Facility (WERF). The purpose of this project is to develop the capability to incinerate low-level beta/gamma contamination waste. After process development has been completed, and incineration system reliability has been proven, the incinerator will be used for volume reduction of the Idaho National Engineering Lab's (INEL) combustible contaminated waste. Future development activities to be performed within the WIDA include ash solidification, alternate off-gas treatment, nuclide migration studies, and remotization of the incineration and ash solidification processes. This project will include systems to characterize the waste and convey the waste to the incinerator, incinerate the waste, cool and drum the resulting ash, and condition and filter the off-gas. Equipment to be installed in support of this task include an x-ray system, conveyors, a controlled air incinerator, ash handling equipment, a heat-exchanger, high temperature ducting, a spark arrester, exhaust fans, HEPA filters and an auxiliary power supply. This project is estimated to cost $1,900,000. Design will be performed by EG & G Idaho, Inc. and construction by Morrison-Knudsen Co. utilizing fixed price subcontracts. Design is scheduled to be completed by the end of February 1982 and construction by the end of July 1982. This schedule assumes funding is and will remain available from the first day of fiscal year 82. Any funding deficiency will directly affect EG & G's ability to meet this schedule.

46183 (INIS-mf—9652, pp 32) **Storage and ultimate storage of radioactive wastes.** Rometsch, R. (Nationale Genossenschaft fuer die Lagerung Radioaktiver Abfaelle (Switzerland)). 1984. (In German). NTIS (US Sales Only), PC A07/MF A01. File Number DE85781476. (CONF-8409235—Summ.).

From Annual meeting of the Austrian Physical Society; Leoben, Austria (24 Sep 1984).

Published in summary form only.

46184 **(Juel—1969) Comparative consideration and design of a security depot for high radioactive glass-enclosed materials.** Jaroni, U. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorentwicklung; Technische Hochschule Aachen (Germany, F.R.)). Jan 1985. 223p. (In German). B. File Number DE85752250.

From the beginning of 1990 the COGEMA shall supply glass-enclosed high radioactive waste of the reprocessing of German fuel elements back to the Federal Republic of Germany. As to this time the final waste storage in the salt stock of Gorleben will not be available the glass cannisters have to be deposited above ground. First a comparison is made out of a number of proposed storage concepts for the deposition of HAW-glass blocks. The safety technical behaviour of the facility is considered. On the basis of the gained results a new facility design is presented, which can

take 450 glass cannisters in a discoid built up cast-steel vessel and makes possible the utilization of the resulting radioactive heat of dissociation. During the development of this concept besides a compact, reasonable method of building and the thermodynamic behaviour of the storage the aspect of high security against release of radioactive materials was emphasized.

46185 **(Juel-Spez—281) Measurement of after-heat production and dose rates of spent AVR fuel elements.** Engelstaedter, R. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorwerkstoffe und Heisse Zellen). Nov 1984. 73p. (In German). B. File Number DE85752240.

Data on the afterheat production and dose rate of spent AVR fuel elements prepared by the ORIGEN computer program are verified by measurements. Individual measurements of afterheat and dose rate were implemented on 17 AVR fuel elements with decay periods of 150 days and more than four years, and burnups between 4.1 and 16.4% fima were implemented in the HOT CELLS at the Juelich Nuclear Research Centre. The radiation energy absorbed in the fuel elements and converted into heat was measured with a calorimeter, whereas the emitted radiation fraction was determined via dose rate measurements. The measured results for fuel elements with decay periods of more than one year are in good agreement with the data from ORIGEN. In the case of fuel elements with shorter decay periods (approx. 150 days) in part considerably lower values were measured which can be explained by the fact that the power gradient in time of the fuel elements in the reactor can vary considerably whereas mean are included in the ORIGEN computations assuming full-load operation.

46186 **(LA-UR—85-2929) Analysis of colloid transport.** Travis, B.J.; Nuttall, H.E. (Los Alamos National Lab., NM (USA); Nuttall and Associates, Inc., Albuquerque, NM (USA)). 1985. Contract W-7405-ENG-36. 7p. (CONF-850995—2; CONF-850981—4). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85017547.

From Materials Research Society international symposium; Stockholm, Sweden (9 Sep 1985).

The population balance methodology is described and applied to the transport and capture of polydispersed colloids in packed columns. The transient model includes particle growth, capture, convective transport, and dispersion. We also follow the dynamic accumulation of captured colloids on the solids. The multidimensional parabolic partial differential equation was solved by a recently enhanced method of characteristics technique. This computational technique minimized numerical dispersion and is computationally very fast. The FORTRAN 77 code ran on a VAX-780 in less than a minute and also runs on an IBM-AT using the Professional FORTRAN compiler. The code was extensively tested against various simplified cases and against analytical models. The packed column experiments by Saltelli et al. were re-analyzed incorporating the experimentally reported size distribution of the colloid feed material. Colloid capture was modeled using a linear size dependent filtration function. The effects of a colloid size dependent filtration factor and various initial colloid size distributions on colloid migration and capture were investigated. Also, we followed the changing colloid size distribution as a function of position in the column. Some simple arguments are made to assess the likelihood of colloid migration at a potential NTS Yucca Mountain waste disposal site. 10 refs., 3 figs., 1 tab.

46187 **(LA-UR—85-3084) Recovery of plutonium by pyroredox processing.** McNeese, J.A.; Bowersox, D.F.; Christensen, D.C. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 14p. (CONF-851048—4). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85017528.

From 168. meeting of the Electrochemical Society; Las Vegas, NV, USA (13 Oct 1985).

Using pyrochemical oxidation and reduction, we have developed a process to recover the plutonium in impure scrap with less than 95% plutonium. This plutonium metal was further purified by pyrochemical electrorefining. During development of the procedures, depleted electrorefining anodes were processed, and over 80% of the plutonium was recovered as high-purity metal in one electrorefining cycle. Over 40 kg of plutonium has been recovered from 55 kg of impure anodes with our procedures. 6 refs., 2 figs., 5 tabs.

46188 **(NUREG/CR—3091-Vol.6) Review of waste package verification tests. Semiannual report, October 1984-March 1985.** Soo, P. (ed.). (Brookhaven National Lab., Upton, NY (USA)). Jul 1985. Contract AC02-76CH00016. 168p. (BNL-NUREG—51630-Vol.6). NTIS, PC A08/MF A01 - GPO. File Number TI85017037.

The potential of WAPPA, a second-generation waste package system code, to meet the needs of the regulatory community is analyzed. The analysis includes an indepth review of WAPPA's individual process models and a review of WAPPA's operation. It is concluded that the code is of limited use to the NRC in the present form. Recommendations for future improvement, usage, and implementation of the code are given. This report also describes the results of a testing program undertaken to determine the chemical environment that will be present near a high-level waste package emplaced in a basalt repository. For this purpose, low carbon 1020 steel (a current BWIP reference container material), synthetic basaltic groundwater and a mixture of bentonite and basalt were exposed, in an autoclave, to expected conditions some period after repository sealing (150°C, ≈10.4 MPa). Parameters measured include changes in gas pressure with time and gas composition, variation in dissolved oxygen (DO), pH and certain ionic concentrations of water in the packing material across an imposed thermal gradient, mineralogic alteration of the basalt/bentonite mixture, and carbon steel corrosion behavior. A second testing program was also initiated to check the likelihood of stress corrosion cracking of austenitic stainless steels and Incoloy 825 which are being considered for use as waste container materials in the tuff repository program. 82 refs., 70 figs., 27 tabs.

46189 **(NUREG/CR—3413) Off-site consequences of radiological accidents: methods, costs and schedules for decontamination.** Tawil, J.J.; Bold, F.C.; Harrer, B.J.; Currie, J.W. (Pacific Northwest Labs., Richland, WA (USA)). Aug 1985. Contract AC06-76RL01830. 379p. (PNL—4790). NTIS, PC A17/MF A01 - GPO. File Number TI85017825.

This report documents a data base and a computer program for conducting a decontamination analysis of a large, radiologically contaminated area. The data base, which was compiled largely through interviews with knowledgeable persons both in the public and private sectors, consists of the costs, physical inputs, rates and contaminant removal efficiencies of a large number of decontamination procedures. The computer program utilizes this data base along with information specific to the contaminated site to provide detailed information that includes the least costly method for effectively decontaminating each surface at the site, various types of property losses associated with the contamination, the time at which each subarea within the site should be decontaminated to minimize these property losses, the quantity of various types of labor and equipment necessary to complete the decontamination, dose to radiation workers, the costs for surveying and monitoring activities, and the disposal costs associated with radiological waste generated during cleanup. The program and data base are demonstrated with a decontamination analysis of a hypothetical site. 39 refs., 24 figs., 155 tabs.

46190 **(NVO—196-45) Nevada Nucler Waste Storage Investigations Project. Quarterly report, April-June 1984.** (Science Applications International Corp., Las Vegas, NV (USA)). Feb 1985. Contract AC08-83NV10270. 76p. NTIS, PC A05/MF A01; GPO Dep. File Number DE85011526.

The Nevada Nuclear Waste Storage Investigations (NNWSI) Project was organized in 1977 to explore the feasibility of siting a high-level waste (HLW) geologic repository on or in the vicinity of the Nevada Test Site (NTS). Investigations have identified a potentially acceptable site located adjacent to the southwestern boundary of the NTS at Yucca Mountain in Nye County, 100 miles northwest of Las Vegas. This document is a compilation of the technical progress reported by Project participants during the third quarter of FY 84. A summary of the project results follows. 2 refs., 2 tabs.

**46191 (ORNL/TM—9599) Anaerobic digestion of cellulosic wastes: pilot plant studies.** Lee, D.D.; Donaldson, T.L. (Oak Ridge National Lab., TN (USA)). Aug 1985. Contract AC05-84OR21400. 54p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85018075.

Anaerobic digestion is a potentially attractive technology for volume reduction of low-level radioactive cellulosic wastes. A substantial fraction of the waste is converted to off-gas, and a relatively small volume of biologically stabilized sludge is produced. Process development work has been completed using a 75-L digester to verify rates and conversions obtained at the bench scale. Start-up and operating procedures have been developed, and effluent was generated for characterization and disposal studies. Three runs lasting 36, 90, and 423 d were made using batch and batch-fed conditions. Solids solubilization rates and gas production rates were approximately double the target values of 0.6 g of cellulose per L of reactor volume per d and 0.5 L of off-gas per L of reactor per d. Greater than 80% destruction of solids was obtained. Preliminary effluent characterization and disposal studies were completed. A simple dynamic process model has been constructed to aid in process design and for use in process monitoring and control of a large-scale digester. 5 refs., 20 figs., 3 tabs.

**46192 (PNL—4465-Rev.1) RECON: a computer program for analyzing repository economics. Documentation and user's manual. Revision 1.** Clark, L.L.; Schutz, M.E.; Luksic, A.T. (Pacific Northwest Labs., Richland, WA (USA)). Jul 1985. Contract AC06-76RL01830. 487p. NTIS, PC A21/MF A01; GPO Dep. File Number DE85017885.

From 1981 through 1984 the Pacific Northwest Laboratory has been developing a computer model named RECON to calculate repository costs from parametric data input. The objective of the program has been to develop the capability to evaluate the effect on costs of changes in repository design parameters and operating scenario assumptions. This report documents the development of the model through September of 1984. Included in the report are: (1) descriptions of model development and the underlying equations, assumptions and definitions; (2) descriptions of data input using either card images or an interactive data input program; and (3) detailed listings of the program and definitions of program variables. Cost estimates generated using the model have been verified against independent estimates and good agreement has been obtained. 2 refs.

**46193 (PNL—4980-Vol.2) Guidelines for selecting codes for ground-water transport modeling of low-level waste burial sites. Volume 2. Special test cases.** Simmons, C.S.; Cole, C.R. (Pacific Northwest Labs., Richland, WA (USA)). Aug 1985. Contract AC06-76RL01830. 203p. NTIS, PC A10/MF A01; 1; GPO Dep. File Number DE85018049.

This document was written for the National Low-Level Waste Management Program to provide guidance for managers and site operators who need to select ground-water transport codes for assessing shallow-land burial site performance. The guidance given in this report also serves the needs of applications-oriented users who work under the direction of a manager or site operator. The guidelines are published in two volumes designed to support the needs of users having different technical backgrounds. An executive summary, published separately, gives managers and site operators an overview of the main guideline report. Volume 1, titled "Guideline Approach," consists of Chapters 1 through 5 and a glossary. Chapters 2 through 5 provide the more detailed discussions about the code selection approach. This volume, Volume 2, consists of four appendices reporting on the technical evaluation test cases designed to help verify the accuracy of ground-water transport codes. 20 refs.

**46194 (PNL—5130) Preliminary analysis of treatment strategies for transuranic wastes from reprocessing plants.** Ross, W.A.; Schneider, K.J.; Swanson, J.L.; Yasutake, K.M.; Allen, R.P. (Pacific Northwest Labs., Richland, WA (USA)). Jul 1985. Contract AC06-76RL01830. 161p. NTIS, PC A08/MF A01; 1; GPO Dep. File Number DE85017692.

This document provides a comparison of six treatment options for transuranic wastes (TRUW) resulting from the reprocessing of commercial spent fuel. Projected transuranic waste streams from the Barnwell Nuclear Fuel Plant (BNFP), the reference fuel reprocessing plant in this report, were grouped into the five categories of hulls and hardware, failed equipment, filters, fluorinator solids, and general process trash (GPT) and sample and analytical cell (SAC) wastes. Six potential treatment options were selected for the five categories of waste. These options represent six basic treatment objectives: (1) no treatment, (2) minimum treatment (compaction), (3) minimum number of processes and products (cementing or grouting), (4) maximum volume reduction without decontamination (melting, incinerating, hot pressing), (5) maximum volume reduction with decontamination (decontamination, treatment of residues), and (6) noncombustible waste forms (melting, incinerating, cementing). Schemes for treatment of each waste type were selected and developed for each treatment option and each type of waste. From these schemes, transuranic waste volumes were found to vary from 1 $m^3$/MTU for no treatment to as low as 0.02 $m^3$/MTU. Based on conceptual design requirements, life-cycle costs were estimated for treatment plus on-site storage, transportation, and disposal of both high-level and transuranic wastes (and incremental low-level wastes) from 70,000 MTU. The study concludes that extensive treatment is warranted from both cost and waste form characteristics considerations, and that the characteristics of most of the processing systems used are acceptable. The study recommends that additional combinations of treatment methods or strategies be evaluated and that in the interim, melting, incineration, and cementing be further developed for commercial TRUW. 45 refs., 9 figs., 32 tabs.

**46195 (PNL—5533) Mobile encapsulation and volume reduction system for wet low-level wastes.** Buelt, J.L. (Pacific Northwest Labs., Richland, WA (USA)). Aug 1985. Contract AC06-76RL01830. 55p. NTIS, PC A04/MF A01; GPO Dep. File Number DE85017871.

This report describes the results of the program entitled "A Preconceptual Study for a Transportable Vitrification Process". The objective of the study is to determine the feasibility of a Mobile Encapsulation and Volume Reduction System (MEVS). The report contains design criteria, a preconceptual design of the system, a comparison of disposal costs with other solidification technologies, and an assessment of utility interests in the transportable volume reduction service MEVS can provide. The MEVS design employs the use of a joule-heated glass melter to convert the wet low-level wastes into glass. The process is self-sufficient, requiring no direct facility services or reactor personnel. It is capable of servicing one waste type from a minimum of three reactors. The design was used to prepare capital and operating cost estimates. The capital cost for the MEVS is $4,680,000, which includes all labor necessary for design, engineering, inspection, and licensing. The operating cost of the system for servicing a minimum of three reactors is $1,530,000/y for resins or $2,280,000/y for concentrated liquids. The cost estimates compared favorably to the more common solidification process of cementation. Total MEVS operating costs which include processing, transportation and burial, are $191 to $218/$ft^3$ waste, whereas quoted costs for cementation and disposal from reactor operators range from $155 to $350/$ft^3$. The report concludes with the requirements for additional development, which can be accomplished for less than one sixth of the capital costs. The report also presents the results of an assessment conducted with utility representatives to obtain their expressions of interest in a service of this type.

**46196 (PNL-SA—13305) Melt foaming, foam stability and redox in nuclear waste vitrification.** Goldman, D.S. (Pacific Northwest Labs., Richland, WA (USA)). 10 Jul 1985. Contract AC06-76RL01830. 16p. (CONF-850755—5). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85017919.

From Symposium on physics and chemistry of glass and glassmaking; Alfred, NY, USA (30 Jul 1985).

Foaming and redox relationships in simulated nuclear waste glasses are reviewed. Foaming is primarily caused by the release of water vapor and oxygen from the melt. Reducing melt conditions minimize foaming problems mainly because foams become unstable at the melt surface. This is suggested to result from glass/water reactions due to an increased proportion of water vapor released under reducing conditions relative to oxygen. The redox state of the glass can be quantitatively measured by the ferrous/ferric

ration, which exhibits theoretical behavior at values above about 0.05, even in the presence of other multivalent species. The ferrous/ferric ratio is thus useful for redox control in the vitrification process in order to avoid foaming under oxidizing conditions and metallic phase formation under highly reducing conditions. Several analytical methods have been evaluated for ease of measurement of the ferrous/ferric ratio, including wet-chemistry, Moessbauer spectroscopy and color analysis of glass powder. The application of these methods for radioactive glasses in a hot-cell environment will pose different problems and will be a challenge for the analyst. Correlations among foaming tendency, foam stability and redox are presented. 3 refs., 5 figs.

46197 **(RHO-BW-SR—85-1-1QP) Basalt Waste Isolation Project drilling and testing. Quarterly report, 1 January 1985-31 March 1985.** (Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations). May 1985. Contract AC06-77RL01030. 27p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85016788.

The Drilling and Testing Group at Rockwell Hanford Operations is responsible for all borehole drilling and testing conducted in support of the Basalt Waste Isolation Project. Geologic and hydrologic characterization data obtained by the group are an integral part of the studies required to determine the feasibility of using the deep basalts beneath the Hanford Site for the terminal disposal of nuclear waste. This document is a summary of drilling and testing during the first calendar quarter (January through March 1985). The principal work during this period included monitoring of the piezometer borehole clusters, testing at RRL-2A, and preparations to deepen borehole DH-28. Specific highlights of this work are summarized in the following paragraphs. Information collected from the piezometer borehole clusters will be used to evaluate time-variant head behavior and to establish a hydraulic head baseline for selected hydrologic units in the reference repository location. Hydraulic heads were monitored in nine horizons within piezometer borehole clusters DC-19, DC-20, and DC-22 during this quarter. Deepening of borehole DH-28 was initiated to further access coincident north-south trending anomalies near the Yakima barricade. During this quarter borehole DH-28 was re-entered, washed, and conditioned in preparation for deepening to 1021 ft (311.2 m). Hydrologic tests were conducted on the lower Cohassett flow interior to assess the hydrologic effects of hydraulic fracturing on the flow interior. Preliminary analysis of hydrologic data indicates no change in hydraulic properties occurred as a result of hydraulic fracturing. 8 refs., 8 figs., 2 tabs.

46198 **(RHO-WM-EV—8P) Preliminary engineering specifications for a test demonstration multilayer protective barrier cover system.** Phillips, S.J.; Gilbert, T.W.; Adams, M.R. (Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations). Mar 1985. Contract AC06-77RL01030. 28p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85016289.

This report presents preliminary engineering specifications for a test protective barrier cover system and support radiohydrology facility to be constructed at the Hanford Protective Barrier Test Facility (PBTF). Construction of this test barrier and related radiohydrology facility is part of a continuing effort to provide construction experience and performance evaluation of alternative barrier designs used for long-term isolation of disposed radioactive waste materials. Design specifications given in this report are tentative, based on interim engineering and computer simulation design efforts. Final definitive design specifications and engineering prints will be produced in FY 1986. 6 refs., 10 figs., 1 tab.

46199 **(RHO-WM-SR—3P) Engineered Barrier Test Facility status report, 1984.** Phillips, S.J.; Adams, M.R.; Gilbert, T.W.; Meinhardt, C.C.; Mitchell, R.M.; Waugh, W.J. (Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations). Feb 1985. Contract AC06-77RL01030. 90p. NTIS, PC A05/MF A01; GPO Dep. File Number DE85017301.

This report provides a general summary of activities completed to date at the Hanford Engineered Barrier Test Facility. This facility is used to test and compare construction practices and performance of alternative designs of engineered barrier cover systems. These cover systems are being evaluated for potential use for isolation and confinement of buried waste disposal structures.

46200 **(SAND—83-1847) Isothermal mechanical response of sediment in the ISHTE simulation experiment.** McTigue, D.F.; Lipkin, J.; Bennett, R.H. (Sandia National Labs., Albuquerque, NM (USA); Sandia National Labs., Livermore, CA (USA); Naval Ocean Research and Development Activity, NSTL, MS (USA)). Mar 1985. Contract AC04-76DP00789. 76p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE85014161.

A simulation of the In Situ Heat Transfer Experiment subjected a large cylindrical sample of deep marine sediment to a hydrostatic pressure of 55.2 MPa. The isothermal mechanical response of this material to pressurization and depressurization is analyzed using a linear theory for a fluid-saturated porous elastic body with compressible constituents. A sudden increase in external fluid pressure causes an undrained deformation and a small negative excess pore pressure (suction) due to the difference in the compressibilities of the fluid and solid. The resulting compressive effective stress relaxes due to Darcy flow of water into the sediment, and the sample expands to recover some of the undrained deformation. Experimental data for sediment surface displacement and excess pore pressure are consistent with the model analysis. Fitting of the model calculations to the data determines four material constants: permeability, drained bulk modulus, and two bulk moduli characterizing the solid clay particles. The first two of these parameters are in reasonable agreement with independent measurements, while the solid moduli are determined here for the first time. A discrepancy between model predictions and data for the pore pressures suggests that external fluid may have penetrated disrupted sediment near the heater. This offers a possible explanation for anomalous geochemical observations in the zone near the heater. 12 refs., 26 figs., 6 tabs.

46201 **(SAND—85-1736C) Treatment of uncertainties in the geologic disposal of radioactive waste.** Cranwell, R.M. (Sandia National Labs., Albuquerque, NM (USA)). 1985. Contract AC04-76DP00789. 17p. (CONF-8508115—2). NTIS, PC A02/MF A01 - GPO. File Number TI85016164.

From American Statistical Association for joint statistical meetings; Las Vegas, NV, USA (5 Aug 1985).

Uncertainty in the analysis of geologic waste disposal is generally considered to have three primary components: (1) computer code/model uncertainty, (2) model parameter uncertainty, and (3) scenario uncertainty. Computer code/model uncertainty arises from problems associated with determination of appropriate parameters for use in model construction, mathematical formulatin of models, and numerical techniques used in conjunction with the mathematical formulation of models. Model parameter uncertainty arises from problems associated with selection of appropriate values for model input, data interpretation and possible misuse of data, and variation of data. Scenario uncertainty arises from problems associated with the "completeness' of scenarios, the definition of parameters which describe scenarios, and the rate or probability of scenario occurrence. The preceding sources of uncertainty are discussed below.

46202 **(UJV—6818-CH) Use of borosilicate system for solidification of nuclear power plant wastes.** Vojtech, O.; Santarova, M.; Voldan, J. (Ustav Jaderneho Vyzkumu CSKAE, Rez (Czechoslovakia)). 1984. 22p. (In Czech). NTIS (US Sales Only), PC A02/MF A01. File Number DE85702221.

The system $Na_2O$-$B_2O_3$-$Al_2O_3$-$SiO_2$ was studied in detail with regard to its use for the solidification of medium-level radioactive wastes. By experiment, in a four-dimensional space the regions of composition were determined where hydrolytic resistance makes the system suitable for solidification. Three samples, corresponding to three experimental points in the four-dimensional space with different ratios of basic components $Na_2O$-$B_2O_3$ were chosen in order to test other properties important for the technological processing of wastes. It was found that suitable fixation products may be prepared with a high waste content exceeding 40% w.w. related to $Na_2O$ and $B_2O_3$. It is moreover possible to replace $Al_2O_3$ in the given system with oxides of corrosion products and $MnO_2$. Hydrolytic resistance of the studied products reaches the quality level of

fixation products of high-level radioactive wastes. The values of viscosity of these vitrified products are suitable for heat processing and at a temperature of 1050 degC the low corrosion activity of the respective melts may be reckoned with. The crystallization ability was found to be negligible which guarantees stability of properties over a long storage period. The possibility of metastable segregation is also low.

46203 **(WINCO—1031) Scoping studies to reduce ICPP high-level radioactive waste volumes for final disposal.** Knecht, D.A.; Berreth, J.R.; Chipman, N.A.; Cole, H.S.; Geczi, L.S.; Kerr, W.B.; Staples, B.A.. (Westinghouse Idaho Nuclear Co., Inc., Idaho Falls (USA)). Aug 1985. Contract AC07-84ID12435. 89p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE85017389.

This report presents the results of scoping studies carried out to determine the feasibility of the following candidate options to reduce high-level waste volume: (1) low-fluoride, low-volume glass, (2) glass-ceramic and ceramic, (3) Modified Zirflex, (4) inerts removal by neutralization, and (5) modified Fluorinel processes. The results of the scoping studies show that the glass-ceramic/ceramic waste forms and neutralization process with potential HLW volume reductions ranging from 60 to 80% appear feasible, based on laboratory-scale tests. The presently used Fluorinel process modified by reducing HF usage also appears to be feasible and could result in up to a 10% potential volume reduction. If the current process start-up tests verify the practicality, reduced HF usage will be implemented. The low-volume glass and Modified Zirflex processes may also be feasible, based on laboratory tests, but would require significantly more process development and/or modifications and could result in only a 20 to 30% potential volume reduction. Based on these scoping studies, it is recommended that (1) the glass-ceramic/ceramic and neutralization processes be developed further, (2) reduced HF use for the Modified Fluorinel process be implemented as soon as practical and other options reducing chemical usage for criticality control be evaluated, (3) basic development for the glass process be continued as a back-up technology, and (4) laboratory-scale radioactive fuel dissolution testing for the Modified Zirflex process be completed with further process development discontinued unless needed in the future.

46204 **Recoverable immobilization of transuranic elements in sulfate ash.** Greenhalgh, W.O. (to Dept. of Energy). US Patent 4,509,978. 9 Apr 1985. Filed date 7 Dec 1982. vp.

PAT-APPL-447569.

Disclosed is a method of reversibly immobilizing sulfate ash at least about 20% of which is sulfates of transuranic elements. The ash is mixed with a metal which can be aluminum, cerium, samarium, europium, or a mixture thereof, in amounts sufficient to form an alloy with the transuranic elements, plus an additional amount to reduce the transuranic element sulfates to elemental form. Also added to the ash is a fluxing agent in an amount sufficient to lower the percentage of the transuranic element sulfates to about 1% to 10%. The mixture of the ash, metal, and fluxing agent is heated to a temperature sufficient to melt the fluxing agent and the metal. The mixture is then cooled and the alloy is separated from the remainder of the mixture.

46205 **Radioactive waste disposal package.** Lampe, R.F. (to Department of Energy). US Patent Application 6-688,673. 4 Jan 1985. 16p. DE85017748 NTIS, PC A02/MF A01; GPO Dep. File Number DE85017748.

A radioactive waste disposal package is claimed comprising a canister for containing vitrified radioactive waste material and a sealed outer shell encapsulating the canister. A solid block of filler material is supported in said shell and convertible into a liquid state for flow into the space between the canister and outer shell and subsequently hardened to form a solid, impervious layer occupying such space. 4 figs.

46206 **Interpretation of gravity data in a complex volcano-tectonic setting, southwestern Nevada.** Snyder, D.B.; Carr, W.J. (Geological Survey, Menlo Park, CA). *Journal of Geophysical Research;* **89**: No. B12, 10,193-10,206(10 Nov 1984).

This regional gravity study was conducted during the past few years at Yucca Mountain, southern Nye County, Nevada, as part of a program to locate a suitable repository for high-level nuclear waste. About 100 surface rock samples, three borehole gamma-gamma logs, and one borehole gravity study provide excellent density control. A nearly linear increase in density of 0.26 g/cm$^3$ per kilometer of depth is indicated in the thick tuff sequences that underlie the mountain. Isostatic and 2.0-g/cm$^3$ Bouguer corrections were applied to the observed gravity values to remove regional gradients and topographic effects, respectively. The Bare Mountain gravity high is connected with a greater gravity high over the Funeral Mountains, to the southwest; together, these highs result from a continuous block of dense, metamorphosed Precambrian and Paleozoic rocks that stretches across much of the Walker Lane from the east edge of Death Valley to Bare Mountain. The Calico Hills gravity high appears more likely to originate from a northeast trending buried ridge of Paleozoic rocks that extends southwestward beneath Busted Butte, 5 km southeast of the proposed repository, where two- and three-dimensional modeling indicates that the pre-Cenozoic rocks lie less than 1000 m beneath the surface. Tuff, at least 4000 m thick, fills a large steep-sided depression in the pre-tuff rocks beneath Yucca Mountain and Crater Flat. The gravity low and the thick tuff section lie within a large collapse area that includes the Crater Flat-Timber Mountain-Silent Canyon caldera complexes. Southward extension of the broad gravity low associated with Crater Flat into the Amargosa Desert is evidence for sector graben-type collapse sediments related to the information of the Timber Mountain caldera and superimposed on the other volcanic and extensional structures within Crater Flat. 48 references, 6 figures, 2 tables.

46207 **(CE-Trans—8014) Development of processes for the inclusion of radioactive waste in glass-metal compounds and ceramic materials.** Lazarev, L.N.; Kuznetsov, Yu.V.; Shashukov, E.A.; Krylov, L.I.; Tutov, A.G.; Dolgov, V.V.; Aloi, A.S.; Dobrygin, P.G.; Romanovskii, V.N.; Strelnikov, A.S. (Central Electricity Generating Board, London (UK). Translations Section; International Atomic Energy Agency, Vienna (Austria)). [1984]. Translation of IAEA-SM-261/61. 18p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85902059.

The paper gives the results of studies into the incorporation of radioactive waste into glass-metal compounds and also into porous inorganic materials which are then converted into vitreous or ceramic products. 6 refs., 5 figs., 3 tabs.

## 0530 Environmental Aspects

*REFER ALSO TO CITATION(S) 46172, 46186, 46190, 46223, 47249, 47281, 47288, 47294, 47295, 47867, 47868*

46208 **(CONF-8409115—19) Application of pathways analyses for site performance prediction for the Gas Centrifuge Enrichment Plant and Oak Ridge Central Waste Disposal Facility.** Pin, F.G.; Oblow, E.M. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 22p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85017096.

From 6. annual Low-Level Waste Management Program participants' information meeting; Denver, CO, USA (11 Sep 1984).

The suitability of the Gas Centrifuge Enrichment Plant and the Oak Ridge Central Waste Disposal Facility for shallow-land burial of low-level radioactive waste is evaluated using pathways analyses. The analyses rely on conservative scenarios to describe the generation and migration of contamination and the potential human exposure to the waste. Conceptual and numerical models are developed using data from comprehensive laboratory and field investigations and are used to simulate the long-term transport of contamination to man. Conservatism is built into the analyses when assumptions concerning future events have to be made or when uncertainties concerning site or waste characteristics exist. Maximum potential doses to man are calculated and compared to the appropriate standards. The sites are found to provide adequate buffer to persons outside the DOE reservations. Conclusions concerning site capacity and site acceptability are drawn. In reaching these conclusions, some consideration is given to the uncertainties and conservatisms involved in the analyses. Analytical methods to quantitative-

ly assess the probability of future events to occur and the sensitivity of the results to data uncertainty may prove useful in relaxing some of the conservatism built into the analyses. The applicability of such methods to pathways analyses is briefly discussed. 18 refs., 9 figs.

46209 **(DOE/OR/20722—55) Niagara Falls Storage Site environmental monitoring report, Lewiston, New York, calendar year 1984.** (Bechtel National, Inc., Oak Ridge, TN (USA). Advanced Technology Div.). Jul 1985. Contract AC05-81OR20722. 55p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85017612.

During 1984, an environmental monitoring program was continued at the Niagara Falls Storage Site, a United States Department of Energy (DOE) surplus facility located in Niagara County, New York, presently used for the storage of radioactive residues, contaminated soils and rubble. The monitoring program measured radon gas concentrations in air; uranium and radium concentrations in surface water, groundwater, and sediments; and external gamma exposure rates. Environmental samples collected were analyzed to determine compliance with applicable standards. Radiation doses to the public were also calculated. During 1984, annual average radon concentrations at the site boundary and exclusion area locations of the site were below the DOE Concentration Guide (CG) for uncontrolled areas. Annual average uranium and radium-226 concentrations in groundwater and surface water were below the DOE CG for release to uncontrolled areas. Sediment samples generally showed average concentrations of uranium and radium-226 lower than those measured in the past years. External gamma exposure rates were below the DOE Radiation Protection Standards. All radiation doses to the public were within DOE standards.

46210 **(DP-MS—85-81) Evaluation and performance of the special wasteform lysimeters at a humid site.** Oblath, S.B.; Hoeffner, S.L. (Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.). Sep 1985. Contract AC09-76SR00001. 14p. (CONF-8509121—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85017251.

From 7. annual DOE LLWMP participants information meeting; Las Vegas, NV, USA (10 Sep 1985).

The Savannah River Laboratory has been evaluating the leaching/migration behavior of commercial power reactor wasteforms by the use of lysimeters operated under field conditions at a humid site. These lysimeters model the conditions in actual burial trenches. Wasteforms comprising Portland cement, masonry cement, and vinyl ester-styrene polymer wasteforms were emplaced in the lysimeters in March 1982. Effluent water has been analyzed on a regular basis since that time. Cs-137, Sr-90, and/or Co-60 have observed in the effluent water from the lysimeters, as well as in soil moisture samples collected from the unsaturated zone beneath the wasteforms. In March of 1984, horizontal cores were taken from one of the lysimeters containing a Portland cement wasteform to determine the vertical and radial profiles of radionuclides which might not have reached the lysimeter sump. Results from all of these sampling methods are discussed and interpreted. 6 refs., 3 figs., 3 tabs.

46211 **(EGG—2386) Environmental surveillance for the INEL Radioactive Waste Mnagement Complex and other areas. Annual report 1984.** Reyes, B.D.; Case, M.J.; Zahn, T.P. (EG and G Idaho, Inc., Idaho Falls (USA)). Aug 1985. Contract AC07-76ID01570. 82p. NTIS, PC A05/MF A01; GPO Dep. File Number DE85016025.

The 1984 environmental surveillance report for the Radioactive Waste Management Complex (RWMC) of the Idaho National Engineering Laboratory describes the environmental monitoring activities at the RWMC, the Waste Experimental Reduction Facility (WERF), and two surplus facilities. The purpose of the monitoring activities is to provide for continuous evaluation and awareness of environmental conditions resulting from current operations, detect significant trends, and project possible future conditions. This report provides a public record comparing RWMC, WERF, and surplus facility environmental data with radiation protection standards or concentration guides established for operation of Department of Energy facilities. 12 refs., 46 figs., 18 tabs.

46212 **(MAFF-S—13(Saf)) Radioactivity in the vicinity of Sizewell nuclear power station: marine environmental monitoring, 1981-1982.** Hunt, G.J. (Ministry of Agriculture, Fisheries and Food, Lowestoft (UK). Fisheries Radiobiological Lab.). 1982. 4p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85702144.

Sizewell inquiry series No. 10.

Regular monitoring by MAFF of radioactivity in the aquatic environment of the British Isles has continued. The results of this programme are presented in relation to the Sizewell nuclear power station for 1981 and 1982, so as to supplement the most recently available full report which was for 1980.

46213 **(NUREG—1157) Environmental assessment for renewal of special nuclear material, License No. SUB-1010 (Docket No. 40-8027).** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Material Safety and Safeguards). Aug 1985. 407p. NTIS, PC A18/MF A01 - GPO. File Number TI85902163.

The proposed action is the renewal of the license necessary for continued operation of the SFC production plant at Gore, Oklahoma. The plant has been in operation with authority to use source material for the production of $UF_6$ since February 1970. In addition to facilities for production of $UF_6$ the site also includes: (1) a storage area for drums of uranium ore concentrates received from uranium mills, (2) a uranium sampling facility, (3) bulk storage of hazardous chemicals such as hydrofluoric (HF), nitric ($HNO_3$), and sulfuric ($H_2SO_4$) acids and tributyl phosphate-hexane solvent, (4) a facility for electrolytic production of fluorine from HF, (5) separate treatment systems and storage ponds for radiological and nonradiological liquid wastes, and (6) a program for disposal of raffinate from a solvent extraction system in the $UF_6$ production as fertilizer on land owned by SFC. 13 figs., 30 tabs.

46214 **(NUREG/CR—4076) Determination of compliance with criteria for final tailings disposal site reclamation.** Beedlow, P.A.; Gee, G.W.; Cline, J.F.; Walters, W.H.; Freeman, H.D. (Pacific Northwest Labs., Richland, WA (USA)). Jun 1985. Contract AC06-76RL01830. 41p. (PNL—5324). NTIS, PC A03/MF A01 - GPO. File Number TI85014154.

This report provides methods and procedures that can be used to verify compliance with Environmental Protection Agency (EPA) engineering standards for uranium mill tailings disposal sites. EPA standards for radon emissions, long-term isolation, and protection of water quality are discussed. Tailings isolation technologies are reviewed. Information the licensee needs to provide for the regulating agency to determine compliance is presented, as is the actual compliance criteria.

46215 **(NUREG/CR—4176) Emission control technology and quality assurance needs at uranium milling facilities: includes supporting methods for testing, operating, and maintaining air pollution control devices.** Ludwick, J.D. (Pacific Northwest Labs., Richland, WA (USA)). Jun 1985. Contract AC06-76RL01830. 56p. (PNL—5386). NTIS, PC A04/MF A01 - GPO. File Number TI85013751.

Pacific Northwest Laboratory, under contract to the US Nuclear Regulatory Commission, conducted an investigation of particulate emission control devices for application to process exhausts at uranium milling facilities. The scope of this investigation included devices now in use, as well as those devices that have potential application for milling sites. This report presents the results of the study. Emission control devices are categorized and described, including high-efficiency and moderate-efficiency devices as well as other (some novel) devices useful in specific situations. Preoperational considerations discussed include selecting devices, instrumentation, and testing programs. Operational and maintenance considerations related to dry and wet removal processes are described. Quality assurance documents and topics are also discussed.

46216 **(PNL-SA—13315) Engineered sorbent barrier screening studies.** Freeman, H.D.; Buelt, J.L. (Pacific Northwest Labs., Richland, WA (USA)). Aug 1985. Contract AC06-76RL01830. 16p. (CONF-8509121—5). NTIS, PC A02/MF A01; GPO Dep. File Number DE85017914.

From 7. annual DOE LLWMP participants information meeting; Las Vegas, NV, USA (10 Sep 1985).

The objective of the Engineered Sorbent Barrier Program is to identify new and cost-effective technology for restricting the migration of radionuclides from low-level waste sites. The primary emphasis is to identify and evaluate sorbent materials as engineered barriers that will prevent radionuclide migration and yet allow moisture to pass. Screening studies have been completed to identify sorbent materials for cesium, cobalt, and strontium. The sorbent materials were selected based on criteria developed for this program and the empirical results of screening studies. The results of the study made it apparent that no single sorbent materials is effective for all radionuclides considered. Therefore, four composite sorbent barriers were identified for further evaluation in 0.6-m diameter columns. The large columns more accurately represent field conditions, generate permeability data, and enhance detectability of radionuclides in the leachate passing through the sorbent barriers. The four sorbent barriers include composites of activated charcoal, greensand, A-51 zeolite, and red pottery clay. Future studies will concentrate on completing the effectiveness evaluations with the large columns and identifying a more cost-effective sorbent material for strontium. 6 refs., 4 figs., 4 tabs.

**46217 (SKI—84-3) Intracoin - International Nuclide Transport Code Intercomparison Study. Final report level 1 - Code verification.** (Swedish Nuclear Power Inspectorate, Stockholm). Sep 1984. 339p. NTIS (US Sales Only), PC A15/MF A01. File Number DE85702225.

The purpose of the project is to obtain improved knowledge of the influence of various strategies for radionuclide transport modelling for the safety assessment of final repositories for nuclear waste. This is a report of the first phase of the project which was devoted to a comparison of the numerical accuracy of the computer codes used in the study. The codes can be divided into five groups, namely advection-dispersion models, models including matrix diffusion and chemical effects and finally combined models. The results are presented as comparisons of calculations since the objective of level 1 was code verification.

## 0540 Health And Safety

*REFER ALSO TO CITATION(S) 46179, 46180, 46213, 47866*

**46218 (DOE/OR/20722—56) Environmental monitoring report for the former Middlesex Sampling Plant and Middlesex Municipal Landfill sites, calendar year 1984.** (Bechtel National, Inc., Oak Ridge, TN (USA). Advanced Technology Div.). Jul 1985. Contract AC05-81OR20722. 48p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85017886.

Bechtel Job No. 14501.

During 1984, the environmental monitoring program was continued at the former Middlesex Sampling Plant (MSP) and former Middlesex Municipal Landfill (MML) sites, located in the Borough of Middlesex, New Jersey. The sites are part of the Formerly Utilized Sites Remedial Action Program (FUSRAP), a United States Department of Energy (DOE) program to decontaminate or otherwise control sites where low-level radioactive contamination remains from the early years of the nation's atomic energy program. The environmental monitoring program is carried out by Bechtel National, Inc., Program Management Contractor for FUSRAP. The monitoring program at the MSP and MML measures the uranium and radium concentrations in surface and groundwater, the radon gas concentrations in air, and external gamma radiation exposure rates. Potential radiation doses to the public are also calculated. All environmental samples collected are analyzed to determine compliance with applicable environmental quality standards. DOE Order 5480.1A, Chapter XI, provides applicable Concentration Guide (CG) limits for radionuclides in controlled and uncontrolled areas. During 1984, average annual concentrations of uranium and radium-226 in groundwater and surface waters monitored for both the MSP and MML remained below the DOE CG for uncontrolled areas. Annual average radon levels in air at both the MSP and MML were below the CG for uncontrolled areas. External gamma monitoring in 1984 showed all monitoring locations at both sites reporting gamma exposure rates below DOE Radiation Protection Standards. All radiation doses to the public were within DOE standards and consistent with 1983 exposure rates. 13 refs., 10figs., 13 tabs.

**46219 (DOE/OR/20722—57) Hazelwood Interim Storage Site environmental monitoring summary, Hazelwood, Missouri, calendar year 1984.** (Bechtel National, Inc., Oak Ridge, TN (USA). Advanced Technology Div.). Jul 1985. Contract AC05-81OR20722. 16p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85017887.

The Hazelwood Interim Storage Site (HISS) is located at 9200 Latty Avenue, Hazelwood, Missouri. The property on which the HISS is situated is owned by the Jarboe Realty and Investment Company and is leased to Futura Coatings, Inc. Radiological surveys in 1977 and 1982 indicated uranium and thorium contamination and elevated radiation levels in the soil on this property and several others in the immediate vicinity. As part of the research and development program authorized by Congress under the 1984 Energy and Water Appropriations Act, Bechtel National, Inc. (BNI) is conducting remedial action on-site and at the vicinity properties. The work is being performed as part of the US Department of Energy (DOE) Formerly Utilized Sites Remedial Action Program (FUSRAP). Jarboe Realty and Investment Company has agreed to permit DOE to store contaminated material from the FY 1984 and 1985 Latty Avenue cleanup on its property. The contaminated material will be added to the existing pile created during the earlier site cleanup. The pile will then be covered to prevent erosion or migration of contamination. The property will be maintained as the HISS by DOE until final disposition for these materials is determined. BNI is conducting a surveillance monitoring program at the HISS during the interim storage period to detect potential migration of contaminants from the storage pile via air, water, and sediment. This summary provides these monitoring data for calendar year 1984. 6 refs., 4 tabs.

**46220 (ORO—847-Rev.1) Remedial action work plan for the Colonie site. Revision 1.** (USDOE Oak Ridge Operations Office, TN). Aug 1985. 44p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85017071.

The Colonie site is a DOE Formerly Utilized Sites Remedial Action Program (FUSRAP) site located in the Town of Colonie, New York, and consisting of an interim storage site and several vicinity properties. The Colonie Interim Storage Site (CISS) is the former National Lead (NL) Industries plant located at 1130 Central Avenue. There are 11 vicinity properties that received remedial action in 1984: 7 located south of the site on Yardboro and Palmer Avenues just across the Colonie-Albany town limits in Albany, and 4 located northwest of the site along Central Avenue in Colonie. Of these properties, nine are residences and two are commercial properties. This document describes the engineering design, construction, and associated plans for remedial action on the vicinity properties and the interim storage site. These plans include both radiological and chemical work. Radiological work includes: excavating the above-guideline radioactive wastes on the vicinity properties; designing required facilities for the interim storage site; preparing the interim storage site to receive these contaminated materials; transporting the contaminated materials to the interim waste storage stockpile; and preparing necessary schedules for accomplishing the remedial actions. Chemical work involves: developing the Resource Conservation and Recovery Act (RCRA) closure plans; neutralizing chemical hazards associated with plating solutions; inventorying on-site chemicals; and disposal of chemicals and/or residues. 17 refs., 5 figs., 1 tab.

**46221 (PNL—5541) Risk assessment in the DOE Assurance Program for Remedial Action.** Marks, S.; Cross, F.T.; Denham, D.H.; Kennedy, W.E.; Stenner, R.D. (Pacific Northwest Labs., Richland, WA (USA)). Aug 1985. Contract AC06-76RL01830. 97p. NTIS, PC A05/MF A01; GPO Dep. File Number DE85017889.

This document provides information obtained during the performance of risk assessment tasks in support of the Assurance Program for Remedial Action (APRA) sponsored by the Office of Operational Safety of the Department of Energy. We have presented a method for the estimation of projected health effects at properties in the vicinity of uranium mill tailing piles due to transported

tailings or emissions from the piles. Because radon and radon daughter exposure is identified as the principal factor contributing to health effects at such properties, the basis for estimating lung cancer risk as a result of such exposure is discussed in detail. Modeling of health risk due to a secondary pathway, ingestion of contaminated, home-grown food products, is also discussed since it is a potentially important additional source of exposure in certain geographic locations. Risk assessment methods used in various mill tailings reports are reviewed. The protocols for radiological surveys conducted in DOE-sponsored remedial action programs are critically reviewed with respect to their relevance to the needs of health risk estimation. The relevance of risk assessment to the APRA program is discussed briefly.

46222 **(RFP—3821) Natural phenomena risk assessment at Rocky Flats Plant.** Foppe, T.L. (Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant). 1985. Contract AC04-76DP03533. 14p. (CONF-8510118—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85016113.

From DOE natural phenomena hazards mitigation conference; Las Vegas, NV, USA (7 Oct 1985).

A realistic approach is currently being used at the Rocky Flats Plant to assess the risks of natural phenomena events. The methodology addresses frequency of occurrence estimates, damage stress on the facility and vital equipment, material-at-risk, release fractions and source terms, leakpath, dispersion and dosimetric models, risk curves, and an uncertainty analysis. 28 refs.

46223 **(SAND—85-7187) Sensitivity analysis of a ship accident at a deep-ocean site in the northwest Atlantic.** Kaplan, M.F. (Analytic Sciences Corp., Reading, MA (USA)). Apr 1985. Contract AC04-76DP00789. 75p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85015369.

This report presents the results of a sensitivity analysis for an HLW ship accident occurring in the Nares Abyssal Plain in the northwestern Atlantic. Waste form release rate, canister lifetime and sorption in the water column (partition coefficients) were varied. Also investigated were the relative importance of the dose from the food chain and from seaweed in the diet. Peak individual doses and integrated collective doses for populations were the units of comparison. In accordance with international guidelines on radiological protection, the comparisons of different options were carried out over "all time"; the study uses a million-year time frame. Partition coefficients have the most pronounced effect on collective dose of the parameters studied. Variations in partition coefficients affect the shape of the collective dose curve over the entire time frame. Peak individual doses decrease markedly when the value for the sorption of americium is increased, but show no increase when less sorption is assumed. Waste form release rates and canister lifetimes affect collective doses only in periods prior to 20,000 years. Hence, comparisons of these options need not be carried out beyond 20,000 years. Waste from release rates below $10^{-3}$/yr (nominal value) affect individual doses in a linear manner, i.e., an order-of-magnitude reduction in release rate leads to an order-of-magnitude reduction in peak individual dose. Little reduction in peak individual doses is seen with canister lifetimes extended beyond the nominal 100 years. 32 refs., 14 figs., 16 tabs.

## 0550 Regulations

*REFER ALSO TO CITATION(S) 46162, 46165, 46170, 46213, 46852, 46856, 47160*

46224 **(BNL—36854) Comments on the law of riots and dissent.** Cadwell, J.J. (Brookhaven National Lab., Upton, NY (USA)). 1985. Contract AC02-76CH00016. 4p. (CONF-850765—34). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85017515.

From 26. annual meeting of the Institute of Nuclear Materials Management; Albuquerque, NM, USA (21 Jul 1985).

All nuclear security organizations provide training to security officers in preparation for a riot or peaceful demonstration which could occur at their facilities. This paper provides a brief discussion of the basis of the constitutional right to engage in freedom of speech, expressed as conduct, which the demonstrators are attempting to exercise. The Court's efforts and success in balancing the interests of the demonstrator's right to "free speech" against competing interests such as national security, trespass laws, keeping government facilities open, and public interest in preventing demonstration, will be discussed. Legal theories available to deal with demonstrators are discussed. The law applicable to the President's use of federal troops and a state governor's use of national guardsmen to prevent or suppress riots is discussed. 10 refs.

46225 (EGG/10282—1057, pp 21.1-21.14) **Safeguards instrument to monitor spent reactor fuel.** Dowdy, E.J.; Holt, D.M.; Nicholson, N.; Stump, C.J. (EG and G Energy Measurements Inc., Los Alamos, NM). Jan 1985. NTIS, PC A19/MF A01. File Number DE85010212. (CONF-830286—).

From Symposium on remote sensing technology; Las Vegas, NV, USA (23 Feb 1983).

A hand-held instrument for monitoring nuclear fuel inventories located in water-filled storage ponds has been developed. This instrument provides sufficient qualitative and quantitative information to be useful as a confirmatory technique for International Atomic Energy Agency inspectors. Because the Cerenkov radiation glow can barely be seen by the unaided eye under darkened conditions, a night vision device is incorporated to aid the operator in locating the fuel assembly to be measured. Both beam splitting optics placed in front of the image intensifier and a preset aperture select a predetermined portion of the observed scene for measurement of the light intensity using a photomultiplier (PM) tube and digital readout. The PM tube gain is adjusted by use of an external optical reference source.

46226 **(Juel-Spez—269) Safeguards concepts for an ultimate storage facility envisaged within the framework of alternative spent fuel management concepts.** Buttler, R.; Lauppe, W.D.; Pohlen, E.; Richter, B.; Stein, G. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Programmgruppe Technik und Gesellschaft). Dec 1984. 145p. (In German). NTIS (US Sales Only), PC A07/MF A01. File Number DE85752326.

Safeguards concepts for the direct final storage of spent fuel in an unexploited salt dome are worked out and evaluated. The considerations are based on a PWR standard fuel element of the Biblis B type with a burn-up of 40,000 MWd/t SM, with an initial enrichment of 3.6%. Many problems are encountered which cannot be solved immediately with the currently available knowledge. Four approaches are explained. A comparison of the main non-proliferation aspects of direct final storage or reprocessing reveals advantages of waste management strategies including reprocessing. In the eight of the facts and results established the conclusion is to be drawn that the waste management strategy with direct final storage is somewhat problematic, from the safeguards point of view, because the technical realisation of a safeguards concept is questionable. For certain types of fuel elements for which reprocessing is not worthwhile, Article 35 of the Verification Agreement may offer a solution. For this case of the limited storage of spent fuel elements, an international central in accordance with this article could be agreed upon.

46227 **(LA—10430-M) Birdcage neutron coincidence counter manual.** Krick, M.S.; Menlove, H.O.; Ramalho, A. (Los Alamos National Lab., NM (USA)). Jul 1985. Contract W-7405-ENG-36. 19p. (ISPO—234). NTIS, PC A02/MF A01; GPO Dep. File Number DE85017954.

A thermal neutron coincidence counter has been constructed for the assay of fast critical assembly fuel plates stored in birdcages. Standard coincidence counting electronics are used. This manual describes the birdcage, the measurement system, and its performance characteristics. 3 refs.

46228 **(LA—10433-M) ION-1 technical manual.** Halbig, J.K.; Caine, J.C. (Los Alamos National Lab., NM (USA)). Jul 1985. Contract W-7405-ENG-36. 41p. (ISPO—240). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85017955.

The portable gamma-ray and neutron detector electronics (ION-1) gives a digital readout of the current-mode response pro-

duced by gamma rays in an ion chamber and of amplification and scaling of pulses received from a neutron detector. The primary application is the measurement of gamma-ray and neutron activity of irradiated reactor fuels stored at a reactor or at a storage pond away from a reactor. ION-1 is the first such instrument to use a design that allows communication of procedures, response, and results between instrument and inspector. It prompts the inspector through procedures, carries out programmed measurement steps, calculates results and error estimates, and performs internal diagnostic checks. This Technical Manual describes adjustment procedures and limited technical information that enable the inspector to troubleshoot at the board level. 5 figs., 10 tabs.

46229 **(LA-UR—85-3043) Sequential test procedures for inventory differences.** Goldman, A.S.; Kern, E.A.; Emeigh, C.W. (Los Alamos National Lab., NM (USA); Nuclear Regulatory Commission, Washington, DC (USA)). 1985. Contract W-7405-ENG-36. 8p. (CONF-850765—35). NTIS, PC A02/MF A01 - GPO; GPO Dep. File Number TI85017532.

From 26. annual meeting of the Institute of Nuclear Materials Management; Albuquerque, NM, USA (21 Jul 1985).

By means of a simulation study, we investigated the appropriateness of Page's and power-one sequential tests on sequences of inventory differences obtained from an example materials control unit, a sub-area of a hypothetical $UF_6$-to-$U_3O_8$ conversion process. The study examined detection probability and run length curves obtained from different loss scenarios. 12 refs., 10 figs., 2 tabs.

46230 **(MLM—3278(OP)) Demonstration of the in-field use of calorimetric assay for IAEA inspection purposes.** Strohm, W.W.; Fiarman, S.; Perry, R.B. (Monsanto Research Corp., Miamisburg, OH (USA). Mound; International Atomic Energy Agency, Vienna (Austria); Argonne National Lab., IL (USA)). 1985. Contract AC04-76DP00053. 5p. (CONF-850765—25). NTIS, PC A02/MF A01; GPO Dep. File Number DE85016448.

From 26. annual meeting of the Institute of Nuclear Materials Management; Albuquerque, NM, USA (21 Jul 1985).

The second physical inventory verification (PIV) exercise for IAEA inspectors was conducted at a US MOX fabrication facility (WHC) under the auspices of BNL/ISPO in 1984. The IAEA bulk calorimeter was introduced into this exercise. Completely nondestructive calorimetric assay was performed using gamma-ray isotopic measurements. The calorimetric assay measurements on selected items from several strata were used to generate HLNC calibration curves completely independent of operator's values. Outliers from HLNC measurements were also measured by calorimetric assay to demonstrate an in-field alternative to withdrawing aliquots for chemical assay. This exercise demonstrated that the IAEA now has the capability of applying calorimetric assay for these purposes. 3 refs., 3 figs., 3 tabs.

46231 **(RFP—3792) High count rate gamma-ray spectrometer system for plutonium isotopic measurements.** Fleissner, J.G.; Oertel, C.P.; Garrett, A.G. (Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant). 1985. Contract AC04-76DP03533. 20p. (CONF-850765—29). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85013212.

From 26. annual meeting of the Institute of Nuclear Materials Management; Albuquerque, NM, USA (21 Jul 1985).

46232 **(SAND—85-0160) Software overview of the Integrated Monitoring System II.** Gallegos, M.H. (Sandia National Labs., Albuquerque, NM (USA)). Aug 1985. Contract AC04-76DP00789. 21p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016916.

The Integrated Monitoring System II (IMS-II) provides intrusion detection for unattended areas containing assets of safeguards interest through the use of motion detectors, video recording equipment, and data storage. This document, in addition to the code listing documentation, provides information regarding the development and future maintenance of the system software. 8 figs.

46233 **(SAND—85-1131C) Lighting simulation and design program (LSDP).** Smith, D.A. (EG and G, Inc., Albuquerque, NM (USA). Kirtland Operations). 1985. Contract AC04-76DP00789. 22p. (CONF-850765—31). NTIS MF A01; 2; GPO Dep. File Number DE85016581.

From 26. annual meeting of the Institute of Nuclear Materials Management; Albuquerque, NM, USA (21 Jul 1985).

This computer program simulates a user-defined lighting configuration. It has been developed as a tool to aid in the design of exterior lighting systems. Although this program is used primarily for perimeter security lighting design, it has potential use for any application where the light can be approximated by a point source. A data base of luminaire photometric information is maintained for use with this program. The user defines the surface area to be illuminated with a rectangular grid and specifies luminaire positions. Illumination values are calculated for regularly spaced points in that area and isolux contour plots are generated. The numerical and graphical output for a particular site model are then available for analysis. The amount of time spent on point-to-point illumination computations with this program is much less than that required for tedious hand calculations. The ease with which various parameters can be interactively modified with the program also reduces the time and labor expended. Consequently, the feasibility of design ideas can be examined, modified, and retested more thoroughly, and overall design costs can be substantially lessened by using this program as an adjunct to the design process. 4 refs., 26 figs.

46234 **(SAND—85-1677C) Positive identity entry control system with geographically distributed portals and enrollment stations.** McIntire, J.M. (Sandia National Labs., Albuquerque, NM (USA)). 1985. Contract AC04-76DP00789. 6p. (CONF-850765—32). NTIS, PC A02/MF A01; GPO Dep. File Number DE85017232.

From 26. annual meeting of the Institute of Nuclear Materials Management; Albuquerque, NM, USA (21 Jul 1985).

A positive identity entry control system using distributed processing to allow reliable geographically separated portals and enrollment stations has been installed and is fully operational at a large area DOE site. Identity verification requires a credential, a memorized number and measurement of a physical characteristic of the user. Additionally, all portal activity is monitored by guards. The portal system is dual redundant such that no single point failure will shut down operations. Each portal site maintains its own subset of the master data base so off-site failure of the central data base manager or its communication links will not significantly affect local portal activity. The system is suitable for installations with large populations requiring access control at several remote sites scattered over a large area. 2 figs.

46235 **(SAND—85-1874C) Safeguards effectiveness evaluation.** Moya, R.W.; Olson, C.E. (Sandia National Labs., Albuquerque, NM (USA)). Aug 1985. Contract AC04-76DP00789. 6p. (CONF-850885—5). NTIS, PC A02/MF A01; GPO Dep. File Number DE85017110.

From 1. annual AFCEA symposium and exposition on physical and electronic security; Philadelphia, PA, USA (19 Aug 1985).

Since the early 1970s Sandia National Laboratories has been involved in the development of safeguards effectiveness evaluation techniques. Several of these techniques have been applied to evaluation of physical protection systems at numerous DOE facilities. This paper discusses the role of safeguards effectiveness evaluation in developing an effective safeguards system and reviews the elements of the design/analysis cycle. Some of the evaluation techniques are also discussed. 1 fig.

46236 **(SAND—85-7180) Federal preemption of state and local nuclear transportation regulations.** Overcast, T.D.; Schuknecht, B. (Battelle Human Affairs Research Center, Seattle, WA (USA)). Aug 1985. Contract AC04-76DP00789. 86p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE85017775.

This report examines the extent to which federal law preempts state and local requirements with respect to the transportation of nuclear materials. We conclude that federal law preempts some, but not all, state and local nuclear material transportation requirements. Section 1 of this report summarizes the judicially devel-

oped doctrines for determining the preemptive effect of federal law. Section 2 places this doctrine in the context of the federal scheme for regulating the transportation of nuclear materials. Section 3 applies the principles developed in Sections 1 and 2 to major categories of state and local nuclear materials transportation requirements. 2 tabs.

46237 **(SAND—85-8227) Tritium control and accountability instructions.** Wall, W.R.; Cruz, S.L. (Sandia National Labs., Livermore, CA (USA)). Aug 1985. Contract AC04-76DR00789. 21p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85017341.

This instruction describes the tritium accountability procedures practiced by the Tritium Research Laboratory, at Sandia National Laboratories, Livermore. The accountability procedures are based upon the Sandia National Laboratories, Livermore, Nuclear Materials Operations Manual, SAND83-8036. The Nuclear Materials Operations Manual describes accountability techniques which are in compliance with the Department of Energy 5630 series Orders, Code of Federal Regulations, and Sandia National Laboratories Instructions.

46238 **(KFK—3835) Pulsed column pilot plant PUSTA.** Feucht, P. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Hauptabteilung Ingenieurtechnik; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Wiederaufarbeitung und Abfallbehandlung). Mar 1985. 61p. (In German). (PWA—83/84). B. File Number DE85752245.

This work summarizes the problems of tritium separation by extraction in the PUREX process. To provide more security for the layout and the operation of a tritium scrubber a pilot plant was realized that allows to carry out extraction experiments in uranium loaded phases under extreme flow ratios. The plant is described and information is given about the experiences with newer methods of measuring out of the extraction research and also about first measuring results.

# 07 ISOTOPE AND RADIATION SOURCE TECHNOLOGY

## 0701 Physical Isotope Separation

46239 (INIS-mf—9351, pp 702-704) **On- and off-line production following the $^{14}N+^{40}Ca$ reaction at 30 MeV/u.** Ollivier, T.; Beraud, R.; Charvet, A.; Duffait, R.; Emsallem, A.; Meyer, M. (Lyon-1 Univ., 69 - Villeurbanne (France). Inst. de Physique Nucleaire); Andre, S.; Barneoud, D.; Foin, C.; Genevey, J. 1984. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781594. (CONF-8409143—).

From 7. international conference on atomic masses and fundamental constants (AMCO-7); Darmstadt-Seeheim, F.R. Germany (3 Sep 1984).

Published in summary form only.

46240 (INIS-mf—9351, pp 68-74) **Direct determination of the masses of unstable atoms with the Chalk River on-line isotope separator.** Sharma, K.S.; Schmeing, H.; Hardy, J.C. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.); Evans, H.C. (Queen's Univ., Kingston, Ontario (Canada)); Hagberg, E. (Queen's Univ., Kingston, Ontario (Canada); Toronto Univ., Ontario (Canada)); Koslowsky, V.T. (Toronto Univ., Ontario (Canada)). 1984. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781594. (CONF-8409143—).

From 7. international conference on atomic masses and fundamental constants (AMCO-7); Darmstadt-Seeheim, F.R. Germany (3 Sep 1984).

In the present work we shall describe a new technique for direct mass determinations with the Chalk River on-line isotope separator. It exploits the programmable acceleration voltage and the high resolution of the separator. The application is not restricted to a specific class of elements, as was the case for previous one-line mass spectrometric techniques, since the separator is equipped with a versatile FEBIAD ion source. In addition, the detection method used in the present work offers highly effective discrimination against unwanted isomers and isobars. This is achieved through high resolution Ge(Li) spectroscopy of the mass analysed radioactive beams. (orig./HSI).

## 0702 Radiation Sources

*REFER ALSO TO CITATION(S) 46492, 47026*

46241 **(CEA-CONF—7419) 14 MeV neutron pulse source.** Garconnet, J.P.; de Mascureau, J.; Boutry, B.; Pauwels, J.C.; Bernardet, H. (CEA Centre d'Etudes de Limeil, 94 - Villeneuve-Saint-Georges (France)). Sep 1984. 10p. (CONF-840922—23). NTIS (US Sales Only), PC A02/MF A01. File Number DE85752154.

From 5. APS topical conference on high temperature plasma diagnostics; Tahoe City, CA, USA (16 Sep 1984).

In order to study the neutron measurement techniques set up in laser interaction experiments with D-T filled targets, we have designed and operated a 14 MeV neutron short pulse source. The device is a sealed neutron gas tube with a hot cathode supplied by an adjustable high voltage pulse generator. Its principle consists in discharging a coaxial cable, held at the generator voltage, into the high impedance neutron head. We then obtain a neutron pulse train with each pulse duration determined by the length of the cable. This source generates a total routine yield of $10^7$ neutrons. A small sized head will be inserted into interaction chambers.

46242 (INIS-mf—9743, pp 57-58) **Operation of consultancy centre for ionizing radiation applications at UJV-Rez.** Teply, J. (Ustav Jaderneho Vyzkumu CSKAE, Rez (Czechoslovakia)). 1984. (In Czech). NTIS (US Sales Only), PC A04/MF A01. File Number DE85781606. (CONF-8411173—).

From Seminar on application of ionizing radiation in foods and feeds treatment; Prague, Czechoslovakia (28 Nov 1984).

The centre elaborates specialized assessments of suggested radiation processes, calculations of technical and economic parameters of radiation processes, radiation fields and shielding, carries out pulse radiolysis and operates irradiation sources for irradiation services. The centre consists of an irradiation room with a $^{60}Co$ source, an accelerator laboratory and an electron paramagnetic resonance laboratory. The work of the centre is incorporated in the research programme of the radiation chemistry department. (J.P.).

46243 (INIS-mf—9743, pp 63-64) **Radiation sources "Perun" and "Radegast" at UVVVR.** Zahalka, J.; Pesek, M.; Prasil, Z.; Rerichova, M. (Ustav pro Vyzkum, Vyrobu a Vyuziti Radioisotopu, Prague (Czechoslovakia)). 1984. (In Czech). NTIS (US Sales Only), PC A04/MF A01. File Number DE85781606. (CONF-8411173—).

From Seminar on application of ionizing radiation in foods and feeds treatment; Prague, Czechoslovakia (28 Nov 1984).

Published in summary form only.

46244 (INIS-mf—9758, pp vp) **Experience acquired during establishment of a radiosterilisation plant in Finland.** Kaituri, M. 1984. (In Swedish). NTIS (US Sales Only), PC A08/MF A01. File Number DE85781601. (CONF-8410282—Absts.).

From 7. Nordic Society for Radiation Protection ordinary meeting; Copenhagen, Denmark (10 Oct 1984).

Published in summary form only.

# 08 HYDROGEN

## 0801 Production

*REFER ALSO TO CITATION(S) 46277, 46286, 46293, 46299, 46302, 46319, 46324, 46343*

**46245 Synthesis and characterization of a benzylviologen surface-derivatizing reagent. N,N'-Bis(p-(trimethoxysilyl)benzyl]-4,4'-bipyridinium dichloride.** Dominey, R.N.; Lewis, T.J.; Wrighton, M.S. (Massachusetts Institute of Technology, Cambridge). *Journal of Physical Chemistry;* **87**: No. 26, 5345-5354(1983).

The preparation of N,N'-Bis(p-(trimethoxysilyl)benzyl]-4,4'-bipyridinium dichloride and the characterization of electrode surfaces functionalized with it are reported. Pt, W, n-Si, and $SnO_2$ electrodes derivatized with the named compound were characterized by electrochemical techniques and surface-sensitive spectroscopic techniques. Reaction mechanisms are proposed.

# 09 OTHER SYNTHETIC AND NATURAL FUELS

*REFER ALSO TO CITATION(S) 47431*

**46246 (CONF-8410310—1) Synthetic fuels: production and products.** Singh, S.P.N. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 26p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85016390.

From Animal toxicology related to energy industries; Knoxville, TN, USA (22 Oct 1984).

A brief primer on synthetic fuels is given. The paper includes brief descriptions of generic conversion technologies that can be used to convert various raw materials such as coal, oil shale, tar sands, peat, and biomass into synthetic fuels similar in character to petroleum-derived fuels currently in commerce. References for additional information on synthetic fuel processes and products are also given in the paper.

## 0901 Hydrocarbon Fuels

*REFER ALSO TO CITATION(S) 46697, 46704*

**46247 (DOE/ET/14700—T1-Vol.8) Synthesis of low molecular weight olefins over coprecipitated iron-manganese catalysts. Volume VIII. Final report.** Wiser, W.H. (Utah Univ., Salt Lake City (USA). Dept. of Fuels Engineering). 15 Jun 1985. Contract AC22-79ET14700. 176p. NTIS, PC A09/MF A01; GPO Dep. File Number DE85014173.

The synthesis of low molecular weight olefins ($C_2$-$C_4$) from hydrogen and carbon monoxide has been investigated over unsupported iron-manganese catalysts. Nine iron-manganese catalysts with different atomic ratios were prepared by coprecipitation of Mn/Fe iron and manganese nitrates. Atomic absorption spectroscopy was used to determine the catalyst compositions. The catalysts were evaluated in a conventional bench-scale fixed bed reactor system. A period of 12 hours was generally required to stabilize the activity and selectivity of the iron-manganese catalysts at the operating conditions investigated: 473 to 483 K temperature, 1465 kPa pressure, 2/1:$H_2$/CO ratio, and 1.08 $cm^3g^{-1}s^{-1}$ reactant gas space velocity. No evidence of catalyst deactivation was detected during the deactivation experiments up to forty hours on stream. A catalyst reduction study with these iron-manganese catalysts was carried out in a thermogravimetric analysis system. A reduction in flowing hydrogen at 673 K and at the ambient pressure for 8 hours was found to be sufficient to activate the catalyst for the carbon monoxide hydrogenation reaction. The hydrogen pretreatment resulted in a relatively more stable pattern of catalyst activity, higher selectivity for $C_2$-$C_4$ hydrocarbons and lower total production of carbon dioxide and methane. The experimental results of the carbon monoxide hydrogenation at the standard catalyst evaluation conditions over a series of iron-manganese catalysts indicated that the catalyst activity generally decreased as the manganese concentration of the catalyst increased; however, the $C_2$-$C_4$ olefin selectivity was significantly enhanced in the presence of a small amount of manganese in the catalyst. 86 refs., 35 figs., 22 tabs.

**46248 (DOE/PC/40077—T9) Liquid hydrocarbon fuels from syngas. Fourteenth quarterly progress report, June-August 1984.** (Union Carbide Corp., Tarrytown, NY (USA). Molecular Sieve Dept.). [1985]. Contract AC22-81PC40077. 307p. NTIS, PC A14/MF A01; 1; GPO Dep. File Number DE85017394.

The objective of the contract is to develop a catalyst and operating conditions for the direct conversion of syngas to liquid hydrocarbon fuels, using microporous crystals ("Molecular Sieves") in combination with transition metals. While none of the eight catalysts tested this quarter matched the catalyst of Run 11677-11 in stability, there was one stable and effective catalyst among them and much valuable information was gained. The effects of process changes in Run 117723-17 (Catalyst 1) are very informative. The higher pressure is not an advantage in these cobalt systems. It raises the initial activity only a little, and accelerates the deactivation rate to the degree that after a relatively short time on stream at 500 psig the syngas conversion is lower than it was at 300 psig. The results with $X_3$ were mixed. Although chemically related to $X_6$, in cobalt Fischer-Tropsch catalysts it acts somewhat differently. It does lower the production of methane, for which purpose the optimum concentration seems to be 2% as much $X_3$ as cobalt, but it does not lower the water gas shift activity as much as $X_6$ does. In addition, it did not perform well in combination with $X_4$ when both were at low concentrations. At higher levels, in Catalyst 7 (Run 1185-02), the combination produced an active and stable catalyst. Thorium appears to be essential in a catalyst containing the $X_4X_3$ combination. It seems to enhance their useful effects, and to minimize their tendency to lower the catalyst's specific activity. The effects of potassium are also mixed. It does increase the water gas shift activity, as in iron catalysts, but it does not contribute to chain growth and seems to impair the catalyst's stability. 289 figs., 27 tabs.

**46249 (DOE/PC/70028—T3) Improved catalysts for liquid hydrocarbon fuels from syngas. Technical progress report, April-June 1985.** (Union Carbide Corp., Tarrytown, NY (USA). Molecular Sieve Dept.). 1985. Contract AC22-84PC70028. 476p. NTIS, PC A21/MF A01; 1; GPO Dep. File Number DE85015537.

The objective of the contract is to consolidate the advances made during the previous contract in the conversion of syngas to motor fuels using Molecular Sieve-containing catalysts and to demonstrate the practical utility and economic value of the new catalyst/process systems with appropriate laboratory runs. Work on the program is divided into the following six tasks: (1) preparation of a detailed work plan covering the entire performance of the contract; (2) preliminary techno-economic assessment of the UCC catalyst/process system; (3) optimization of the most promising catalysts developed under prior contract; (4) optimization of the UCC catalyst system in a manner that will give it the longest possible service life; (5) optimization of a UCC process/catalyst system based upon a tubular reactor with a recycle loop; and (6) economic evaluation of the optimal performance found under Task 5 for the UCC process/catalyst system. Accomplishments are reported for Tasks 2 through 5.

**46250 (DOE/PC/70788—T2) FTIR studies of hydrocarbon synthesis on Pd/ZSM5 catalysts. Quarterly progress report, August 15, 1985.** Wolf, E.E. (Notre Dame Univ., IN (USA). Dept. of Chemical Engineering). 15 Aug 1985. Contract FG22-84PC70788. 11p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85016646.

During the last quarter several objectives were attained: (1) Pd/ZSM5 catalysts are capable of methanol and hydrocarbon synthesis. (2) The temperature and pressure dependence of the reaction rates were established. The reaction rate increases with temperature and pressure, and is independent of residence time. (3) Methanol yield reaches a maximum as pressure increases, and it decreases as temperature increases. (4) Ir spectra are dominated by the linear and bridge bonded forms of CO, as well as by bands at 1550 to 1400 $cm^{-1}$. 9 figs.

**46251 (DOE/R3/06073—T1) Use of methane in the distillation of alcohol. Final report.** Bertrand, F.J. (Bertrand (Frank J.), Towanda, PA (USA)). 7 Oct 1981. Contract FG43-79R306073. 8p. NTIS, PC A02. File Number DE85009198.

A methane-bio-gas generator was constructed then coupled with an experimental alcohol distillation apparatus in the hope of producing burnable alcohol and animal-grade feed. Two designs were employed; neither accomplishing the desired results. 1 fig.

**46252 (IIASA-RR—84-19) Alternative routes from fossil resources to chemical feedstocks: the problem, a methodological approach, and the case of methanol.** Dobrowolski, G.; Zebrowski, M.; Kopytowski, J.; Wojtania, J. (International Inst. for Applied Systems Analysis, Laxenburg (Austria)). Sep 1984. 60p. NTIS (US Sales Only), PC A04/MF A01. File Number TI85902107.

This paper represents the first and possibly the most important step in our research on the problem of developing new sources of chemical feedstocks through industrial structural change. The PDA concept provides a very useful way of structuring the problem, confirming expectations based on its use in earlier work (generating a development program for the chemical industry). This has given us a considerable degree of confidence in the PDA model. The methodology developed so far makes use of and develops our earlier concept of a quest for concordance between available resources and available technologies. Although further methodological work remains to be done, the theoretical basis of the approach appears to be sound, and the results obtained so far seem very encouraging. Our results are in general agreement with papers dealing with the use of fossil resources for energy supply. We note with satisfaction that energy researchers are moving perceptibly closer to our area - the emerging common ground may be called energo-chemical processing of fossil resources. Since there is an explicit complementarity between these approaches, we expect to cooperate closely with the relevant IIASA projects in the future. For the dual reasons of clarity and limited space, this report does not include many of our findings. These are concerned with various problems based on prices and their evaluation using sensitivity analysis and postoptimal analysis, and will be published separately. Much important mathematical background has also been omitted.

**46253 (PNL-SA—13104) Medium-Btu gas from biomass: progress and prospects.** Gerber, M.A.; Schiefelbein, G.F. (Pacific Northwest Labs., Richland, WA (USA)). Apr 1985. Contract AC06-76RL01830. 11p. (CONF-850808—21). NTIS, PC A02/MF A01; GPO Dep. File Number DE85017863.

From 20. intersociety energy conversion engineering conference; Miami Beach, FL, USA (18 Aug 1985).

This paper reviews the biomass gasification research sponsored by the Biomass Energy Technology Division (BETD) of the US Department of Energy. Emphasis is placed on recent research results on the gasification of biomass and the prospects for future research. The main thrust of this research is to produce a clean, nitrogen free, medium-Btu gas, which typically has a higher heating value of 12 to 21.5 MJ/Nm$^3$. This research is investigating several promising reactor designs and reactor heating methods in an effort to identify processes with strong potential for further development by private industry. 10 refs., 7 figs., 6 tabs.

**46254 (STEV-BF—85-2) Hydroprocessing.** Gevert, B. (Statens Energiverk, Stockholm (Sweden)). Dec 1984. 142p. (In English and Swedish). NTIS (US Sales Only), PC A07/MF A01. File Number DE85752553.

A batch reactor for catalytic hydroprocessing of heavy oils, in particular biomass oils, has been installed. Synthetic oil from biomass has been hydrogenated; oxygen reduction and coking has been studied. The heavy oils have been fractionalized through vacuum distillation and extraction.

**46255 Effect of Liquid Composition on the Slurry Fischer-Tropsch Synthesis. 1. Rate of Reaction.** Satterfield, C.N.; Stenger, H.G. (Department of Chemical Engineering, Massachusetts Institute of Technology, Cambridge, Massachusetts). *Industrial and Engineering Chemistry Process Design and Development;* **24**: No. 2, 407-411(Apr 1984).

With a reduced fused magnetite catalyst, the rate of reaction in the presence of phenanthrene is nearly twice that observed in the presence of n-octacosane even though the solubility of $H_2$ and CO is moderately less in phenanthrene. The rate in the presence of triphenylmethane was about the same as in n-octacosane. In the presence of a perfluoropolyether, the rate of reaction was markedly reduced, even though $H_2$ and CO solubilities are much higher than in hydrocarbons. This was attributed to substantial mass transfer resistances through an encapsulating hydrocarbon layer around the catalyst particles. The effect of the nature of a liquid on several other reactions is also discussed.

**46256 Effect of Liquid Composition on the Slurry Fischer-Tropsch Synthesis. 2. Product Selectivity.** Stenger, H.G.; Satterfield, C.N. (Department of Chemical Engineering, Massachusetts Institute of Technology, Cambridge, Massachusetts). *Industrial and Engineering Chemistry Process Design and Development;* **24**: No. 2, 411-415(Apr 1984).

With a reduced, fused magnetite catalyst, secondary reactions, consisting of olefin hydrogenation, olefin isomerization, and incorporation of ethylene and/or ethyl alcohol into product, were slightly greater in octacosane than in phenanthrene at 232°C but essentially the same at 263°C. This is attributed to competitiv adsorption effects with phenanthrene which adsorbs significantly onto the catalyst at 232°C, but not at 263°C. All secondary reactions are enhanced by conditions minimizing CO adsorption. Oxygenates were greatly diminished at high conversions. $C_2$ incorporation into product stops chain growth by a scavenging effect. In the presence of a perfluoropolyether (Fomblin), in which hydrocarbons are immiscible, catalyst is preferentially wetted by hydrocarbons and secondary reactions are greatly enhanced by mass transfer resistances.

**46257 Effects of Sulfur Poisoning of a Reduced Fused Magnetite Catalyst in the Fischer-Tropsch Synthesis.** Stenger, H.G.; Satterfield, C.N. (Department of Chemical Engineering, Massachusetts Institute of Technology, Cambridge, Massachusetts). *Industrial and Engineering Chemistry Process Design and Development;* **24**: No. 2, 415-420(Apr 1984).

Addition of $H_2S$ to synthesis gas with catalyst suspended in octacosane increased catalyst activity by 60% at a sulfur loading of 1.3 mg of S/g of Fe, beyond which catalyst activity decreased. Dibenzothiophene (DBT) present in phenanthrene during catalyst activation did not exhibit this effect. The two poisons reduced activity comparably at loadings of about 10 mg of S/g of Fe. Unlike $H_2S$, DBT caused a marked drop in selectivity to form methane and an increase in olefin/paraffin ratio of products, indicating that it decreased the hydrogenation capability of the catalyst. Effects of the two poisons on olefin isomerization and oxygenate concentrations are also presented.

**46258 (BGC/MRS/M—14951) Investigation on the behavior of liquefied fuel gases escaping into the open atmosphere. Part 2. Experiments with liquefied propane and butane - evaluation of tests - final conclusions.** Lutzke, K. Translated from *Erdoel und Kohle, Erdgas, Petrochemie vereinigt mit Brennstoff-Chemie ;* **24**: No. 4, 231-238(Apr 1971). 24p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85902077.

The experiments on the escape of gaseous and liquefied propane and butane were performed outdoors. The escape took place at a height of 0.28 m above the ground in, against and at right angles of the direction in which the wind blows. The emergence mass flow rates were in general between approximately 100 and 300 kg/h, i.e., they were leak rates which could not be ignored or overlooked. The experiments with gaseous propane were evaluated on the basis of the free jet theory and were compared with the results for a circular free jet. The thermal concentration field is critical for the assessment of the maximum ignition distances from the emergence location. It was established that for similar experimental conditions it was possible to assess in a first approximation the maximum ignition distance by the free jet theory even when the wind exercised an effect. The case of dead calm is included in this connection. On assumption of an emergence mass flow rate of 3 kg/min equivalent to 180 kg/h for the maximum leak rate as limiting

value we obtained at dead calm for propane an estimated figure of 2.4 m from the emergence location for propane, and 2.7 m for butane. No ignitions at greater distances from the place of emergence of the gaseous liquefied gas under the given experimental conditions need be feared. The results of the emergence experiments with liquefied propane and butane were plotted on graphs and on the basis of the formula postulated by Sutton we formulated an empirical equation for assessing the maximum ignition distance under similar experimental conditions. On employing an emergence mass flow rate of 180 kg/h as critical value for a maximum possible leakage, we found both for propane and butane related to a wind velocity of 1 m/s on emergence in the direction of the wind a maximum ignition distance of approximately 8 m and on emergence against the direction of the wind a maximum ignition distance of approximately 7.5 m.

## 0902 Alcohol Fuels

*REFER ALSO TO CITATION(S) 46712*

**46259 Progressing batch hydrolysis process.** Wright, J.D. (to Dept. of Energy). US Patent A 6-690,544. 10 Jan 1985. 29p. Contract AC02-83CH10093. DE85017754 NTIS, PC A03/MF A01; GPO Dep. File Number DE85017754.

A progressive batch hydrolysis process is disclosed for producing sugar from a lignocellulosic feedstock. It comprises passing a stream of dilute acid serially through a plurality of percolation hydrolysis reactors charged with feed stock, at a flow rate, temperature and pressure sufficient to substantially convert all the cellulose component of the feed stock to glucose. The cooled dilute acid stream containing glucose, after exiting the last percolation hydrolysis reactor, serially fed through a plurality of pre-hydrolysis percolation reactors, charged with said feedstock, at a flow rate, temperature and pressure sufficient to substantially convert all the hemicellulose component of said feedstock to glucose. The dilute acid stream containing glucose is cooled after it exits the last prehydrolysis reactor.

## 0904 Solid Waste And Wood Fuels

*REFER ALSO TO CITATION(S) 46315, 46352, 46631, 46696, 46704*

**46260 (CONF-8305285—) Proceedings of the first international seminar on wood-based energy production.** (Swedish Commission for Technical Cooperation). 1983. 132p. NTIS (US Sales Only), PC A07/MF A01. File Number DE85752506.

From 1. international seminar on wood-based energy production; Faerna, Sweden (1 May 1983).

The seminar covered the following three aspects: wood for domestic energy, wood for oil substitution and wood energy for rural development. It was set out to deal with the whole system-right from the forest through to the end-user of heat, mechanical power or electricity. Techniques and methods for various energy systems were presented. Care was taken to distinguish between proven technology and those technologies which are still at the prototype or blueprint stage. Emphasis was laid on utilizing forest and forest industry residues. Some of the administrative problems relating to the multi-disciplinary and poly-sectoral character of the projects were discussed. The views of international bankers and aid organisations regarding wood energy investments were presented during the seminar.

**46261 (NP—5752541) Wood powder.** Aabom, J. (Statens Energiverk, Stockholm (Sweden)). Aug 1982. 60p. NTIS (US Sales Only), PC A04/MF A01. File Number DE85752541.

The purpose of this research project is to develop an economical and feasible system for production of wood powder for burning in furnaces in industries and buildings. The project also concerns itself with the production of powder in such forms and consistencies that it can be used as fuel in smaller units, for example in house furnaces, working with the same degree of automation as oil burning ones. In the future, wood powder is also being planned for use in diesel engines. Studies show that with existing technology, it is possible in Sweden to produce wood-based raw materials for production of powder equivalent to a substantial part of our need of imported oil. Through in-plant study vistis and quotation inquiries, contacts have been made with domestic and foreign manufacturers of grinding equipment which in most cases can be used for industrial production of wood powder after simple modifications. Equipment for burning wood powder already has been developed for effects of up till 8.6 MW (Europe) and 30 MW (USA) per burner. A wood powder burner in the effect area of 5-80 kW intended for single family houses has been developed at Chalmers Univeristy of Technology. Contacts have been made with manufacturers of furnaces for wood powder to determine the componental corrosion resistance. A positive environmental factor in the transition from oil and/or coal based power or heat production, to the use of wood powder energy, is the low sulphur level in powder fuel. With the manufacturing method proposed by the study, the production cost for one kilo dry wood powder is 52 oere, if the price of wood is 40 oere per kilo dry wood. The amount of energy or the heat value in one kilo dry wood powder amounts with a capacity for 160000 t powder fuel per year. The term -atro- used throughout the text refers to absolutely dry material.

**46262 (STEV-FBA—85-4) Survey and evaluation of existing plants.** Stridsberg, S.; Nordstroem, S. (Statens Energiverk, Stockholm (Sweden)). Oct 1983. 22p. (In Swedish). NTIS (US Sales Only), PC A02/MF A01. File Number DE85752550.

Operational difficulties have been studied and the influence of winter conditions has been investigated. Solid biomass fuels imply special difficulties, especially fine powders, sticky chips of unsorted size. Quality control should be developed and new supervision procedures for the plants must be compiled.

**46263 (STEV-SB—85-2) Testing the utilization and preparation of timber ends.** Pettersson, S.E. (Statens Energiverk, Stockholm (Sweden)). 1985. 33p. (In Swedish). NTIS (US Sales Only), PC A03/MF A01. File Number DE85752534.

The systems have been tested and evaluated both technically and economically. In total about 10400 $m^3$ of stubs have been treated. The shortcomings of the technical equipment and production systems are discussed. The cost per $m^3$ of chip preparation was between SEK 143 and SEK 171. The average dry content was 82.3% and the energy value was 18.7 MJ per kg dry substance.

**46264 (STEV-TORV—85-2) Sampling for biofuel analysis.** Persson, J.Aa. (Statens Energiverk, Stockholm (Sweden)). Nov 1984. 36p. (In Swedish). (SMS—12). NTIS (US Sales Only), PC A03/MF A01. File Number DE85752525.

This project reviews methods for sampling biofuels, i.e. wood chips, chrushed wood wastes, sod peat and milled peat. A Swedish standard for sampling will later be worked out from this material. It was found that the fuel can be very inhomogeneous - variations in dry matter content of up to 20 per cent were noticed - which means that it is very hard to get high precision in the analysis of one shipment.

**46265 (STEV-TORV—85-3) Determination of fractions for wood fuels.** Stridsberg, S. (Statens Energiverk, Stockholm (Sweden)). Nov 1984. 55p. (In Swedish). (SMS—13). NTIS (US Sales Only), PC A04/MF A01. File Number DE85752523.

Methods and equipment for screening biofuels are discussed in this report. The following fuels are studied: Wood chips, Crushed wood wastes, Bark and Peat. A modified CCL-sieve is found to be well suited for these fuels. (The CCL-sieve was developed for screening wood chips in paper industry). Drying to 80-90 per cent dry content is necessary before the screening can take place. Recommendations are made for the procedures and reports of the analyses.

# 13 HYDRO ENERGY

**46266 (DOE/ID—10132) DOE Small-Scale Hydropower Program. Annual report 1985.** Rinehart, B.N.; Chappell, J.R.; Sommers, G.L. (EG and G Idaho, Inc., Idaho Falls (USA)). Sep 1985. Contract AC07-76ID01570. 88p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE85017977.

This report summarizes the research and development and technology transfer activities of the US Department of Energy's (DOE's) Small-Scale Hydropower Program for fiscal year 1985, and provides an annotated bibliography of research, engineering, operations, regulations, and costs of projects pertinent to hydropower development. The Small-Scale Hydropower Program is reported in five sections: Technology Development, Engineering Research and Development, Technology Transfer, Environmental Research, and Legal and Institutional Aspects. The bibliography discusses reports written by both private and non-Federal Government sectors.

## 1301 Resources And Availability

*REFER ALSO TO CITATION(S) 46690*

## 1302 Site Geology And Meteorology

**46267 (NP—5752642) Estimation of runoff conditions in the Taseq area near Narssaq, South Greenland.** Braithwaite, R.J. (Groenlands Geologiske Undersoegelse, Copenhagen (Denmark)). May 1981. 14p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85752642.

The Taseq area, near Narssaq in South Greenland, is being considered for the development of a hydropower project. A simple model is applied to a five-year measured runoff series from Narssaq Elv to transfer it to the Taseq area for an extended period. The calculated results for mean runoff show reasonable agreement with earlier estimates of runoff by the Greenland Technical Organization (GTO) although they do indicate a slightly lower hydropower potential, i.e. about 21-26 GWh/year. However, there is a problem in determining the correct variability of the runoff so that estimation of safe yield and reservoir capacity is problematic. One version of the model predicts a low variability for the runoff but there are also possible indications of high variability which would dictate a low yield and would require a large reservoir. Further investigations, both in the field and by simulation, ought to solve this problem.

## 1306 Environmental Aspects

*REFER ALSO TO CITATION(S) 47331*

**46268 (DOE/BP—242) Yakima River Basin fish passage enhancement plan.** (USDOE Bonneville Power Administration, Portland, OR. Div. of Fish and Wildlife). Sep 1984. 32p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85017285.

A status report on the development and maintenance of fish passage facilities along the Yakima River. (DT)

**46269 (DOE/BP/35346—1) Bioenergetics of juvenile salmon during the spring outmigration. Annual report 1983.** Rondorf, D.W.; Dutchuk, M.S.; Kolok, A.S.; Gross, M.L. (Fish and Wildlife Service, Cook, WA (USA). Willard Field Station). Aug 1985. Contract AI79-82BP35346. 87p. NTIS, PC A05/MF A01; GPO Dep. File Number DE85017432.

Main stem reservoirs in the Columbia River Basin may have increased the energy demands of smolts during outmigration by prolonging migration and exposing smolts to seasonally rising water temperatures. A bioenergetic model for spring chinook salmon smolts (Oncorhynchus tshawytscha) is being developed to test these hypotheses. Results have thus far indicated that the seaward migration can be separated into two distinct phases. Phase I can be described as a period of intense smolt development in which there was a post hatchery release surge in gill $Na^+$-$K^+$ ATPase activity, depletion of energy available in body lipids, and a concurrent decline in caloric density. Phase II was characterized by maintenence of smolt status in apparent anticipation of reaching the estuary. Phase II is the period most affected by impoundments and annual changes in water flow; the latter period will therefore be modeled in bioenergetic simulations. Laboratory and field observations provided input parameters for the model and empirical data to verify model simmulations. Total calories, caloric density, proximate body composition, ration, and caloric intake were determined in smolts as seaward migration progressed. The effect of swimming and starvation on energy reserves and seawater survival were determined in the laboratory. Fatty acid analysis indicated $\omega 3$ neutral fatty acids influenced smolt development and seawater survival. 46 refs., 13 figs., 4 tabs.

# 14 SOLAR ENERGY

**46270 (DOE/IR/10342—T1) [Rural Solar Electric Project]. Final report.** Tijerina, K. (Northern California Indian Development Council, Inc., Eureka). 29 Oct 1981. Contract FG01-80IR10342. 6p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85017333.

The project consisted of installing solar electric units in 27 low income homes in a rural community to power household appliances. A questionnaire was used to determine the impact and performance of the units. The solar units most effectively supplemented the use of petroleum-derived fuels. The payback period for the units was found to be 4 years. A summary of the findings of the questionnaire is included.

**46271 (EFN—8) Solar energy for power generation and fuel production. Review of technology and development.** Engstroem, L. (Energiforskningsnaemnden, Stockholm (Sweden)). 1984. 182p. (In Swedish). NTIS (US Sales Only), PC A09/MF A01. File Number DE85752531.

The report gives a brief outline of the Swedish and international research and development of utilization of solar energy for heating processes based on direct solar radiation, power generation in solar cells and photochemical conversion of solar energy to electricity and fuels.

## 1401 Resources And Availability

**46272 (DOE/JPL—1060-88) View-limiting shrouds for insolation radiometers.** Dennison, E.W.; Trentelman, G.F. (Jet Propulsion Lab., Pasadena, CA (USA)). 15 May 1985. Contract AM04-80AL13137. 27p. (JPL-PUB—85-54). NTIS, PC A03/MF A01; GPO Dep. File Number DE85017590.

Insolation radiometers (normal incidence pyrheliometers) are used to measure the solar radiation incident on solar concentrators for calibrating thermal power generation measurements. The measured insolation value is dependent on the atmospheric transparency, solar elevation angle, circumsolar radiation, and radiometer field of view. The radiant energy entering the thermal receiver is dependent on the same factors. The insolation value and the receiver input will be proportional if the concentrator and the radiometer have similar fields of view. This report describes one practical method for matching the field of view of a radiometer to that of a solar concentrator. The concentrator field of view can be calculated by optical ray tracing methods, and the field of view of a radiometer with a simple shroud can be calculated by using geometric equations. The parameters for the shroud can be adjusted to provide an acceptable match between the respective fields of view. Concentrator fields of view have been calculated for a family of paraboloidal concentrators and receiver apertures. The corresponding shroud parameters have also been determined. The effectiveness of this technique has been tested by comparing radiometer and concentrator measurements under a variety of sky conditions. Appropriate radiometer shrouds should be used to obtain accurate insolution measurements for determining solar concentrator and power conversion system efficiencies and for site surveys.

**46273 (EUR—9259-EN) Studies on the measurement of solar radiation.** McGregor, J. (Commission of the European Communities, Luxembourg. Directorate-General for Information, Market and Innovation). 1984. 110p. Commission of the European Communities, Luxembourg. Office of Official Publications of the European Communities.

This report presents a preliminary analysis of the data obtained from a comparative study of cosine and tilt effect in a sample of eight Kipp and Zonen CM-5 pyranometers. The study was made using the National Institute of Agricultural Engineering's Spatial Response Goniometer. The results revealed that the effect of tilting pyranometers is less than +-0.3% throughout the full range of tilt angles, though these results were obtained for relatively low levels of irradiance (approx.=150wm$^2$) and one would expect error to increase with incidence irradiance (see Gillett, 1981). Errors in the departure from true cosine response are however much greater in magnitude and are thus much more serious. The situation is complicated by the lack of azimuthal symmetry in the detector, which reveals an azimuthal as well as an elevation dependence of departure from true cosine response. Probably even more important however is the variation in the cosine behaviour from instrument to instrument which was revealed by the results and these have important implications for indoor and outdoor calibrations. A brief analysis of these implications is presented here.

**46274 (EUR—9482-EN) Estimation of hourly solar irradiation over the UK.** Rawlins, F. (Commission of the European Communities, Luxembourg. Directorate-General for Information, Market and Innovation). 1984. 81p. Commission of the European Communities, Luxembourg. Office of Official Publications of the European Communities.

The principal objective is to obtain methods of estimating climatological averages of the components of hourly irradiation, using hourly sunshine records, with a small number of empirical constants. This approach was not extended to include estimation explicitly for inclined surfaces: a more physically based representation was deemed necessary for further progress. The estimation of global irradiation on a horizontal surface is achieved from a simple linear relation with bright sunshine, similar to the Angstroem equation. The large number of hourly regression coefficients possible is reduced by inferring approximate values from monthly coefficients. The estimation of hourly irradiation, integrated over individual months, leads to RMS errors of about 10%, and affords some advantage over the method of Liu and Jordan (1960). The estimation of direction irradiation on a sun-following surface adopts a value of turbidity calculated from the sum of Angstroem global irradiation coefficients. The effect of thin cloud is empirically represent by a function of hourly sunshine. Errors of climatological hourly means are estimated to be about 10%, but hourly RMS errors of individual months exceed 20%, so that HISUN is unsuitable for periods of less than about 10 years. The ratios of mean hourly to mean daily sunshine from a number of sites are combined to give a single table of values, dependent upon daylength, allowing the estimation of hourly from daily sunshine. Average daily sunshine from 150 stations is used to construct hourly irradiation maps for the United Kingdom by an objective scheme which employs low order orthogonal polynomials to smooth the irradiation fields and to provide values for data sparse areas.

## 1403 Economics

*REFER ALSO TO CITATION(S) 46345*

**46275 (DOE/CS/30630—T1) Approach to estimating private sector investment in research and development for active solar heating and cooling systems.** Gordon, J.J. (Mitre Corp., McLean, VA (USA). METREK Div.). Sep 1982. Contract AC01-81CS30630. 63p. NTIS, PC A04/MF A01; GPO Dep. File Number DE85017408.

In support of the US Department of Energy's Office of Solar Heat Technologies, MITRE developed an approach to estimating the amount of funding private industry may be willing to invest in solar R & D. This report presents a review of the characteristics of privately funded R & D in the US and a discussion of R & D project selection techniques in the private sector. Implications for privately funded solar R & D are discussed, and the approach to estimating private sector solar R & D expenditures presented, using R & D on evacuated tube solar collectors as an illustration. The approach developed uses a variant of net present value analysis. This methodology is particularly useful for assessing whether R & D funding of solar energy systems will be profitable from a private sector decision making point of view.

**46276 (NP—5752626) International Energy Agency solar heating and cooling program. Task 1. Investigation of the performance of solar heaing and cooling systems. Optimization.** (Danmarks Tekniske Hoejskole, Lyngby. Lab. for Varmeisolering). Jun 1981. vp. Danmarks Tekniske Hoejskole, Lyngby. Lab. for Varmeisolering.

A review of general techniques and specific methods useful in the optimization of solar heating and cooling systems is undertaken. A discussion of the state of the art and the principal problems in both the simplified thermal performance analysis and economic analysis portions of the optimization problem are presented. Sample economic analyses are performed using several widely used economic criteria. The predicted thermal results of one typical, widely used simplified method is compared to detailed simulation results. A methodology for and the results of a sensitivity study of key economic parameters in the life cycle cost method are presented. Finally, a simple graphical optimization technique based on the life cycle cost method is proposed.

## 1404 Environmental, Legal, And Institutional Aspects

*REFER ALSO TO CITATION(S) 46345*

## 1405 Solar Energy Conversion

*REFER ALSO TO CITATION(S) 46251, 46253, 46259, 46261, 46262, 46263, 46264, 46265, 46619, 46620, 46631, 47268*

**46277** (ANL—84-95, pp 1-5) **Splitting water the photosynthetic way.** Sauer, K. (Lawrence Berkeley Lab., CA). Nov 1984. NTIS, PC A10/MF A01. File Number DE85005094. (CONF-8406218—Absts.).

From 8. DOE solar photochemistry research conference; Lake Geneva, WI, USA (11 Jun 1984).

Using optical, EPR, and x-ray absorption spectroscopy, intermediates are characterized for a light reaction involved in photosynthetic water splitting. These intermediates include a manganese-containing protein, a non-heme iron in spin state S = 5/2, a protonated semiquinone cation, chlorophyll a (P680), pheophytin a, a plastoquinone complex, a protein site where quinones accumulate electrons in pairs, and a pool of plastoquinone. 3 references.

**46278** (ANL—84-95, pp 6-10) **Studies of the mechanism of intramolecular electron transfer in linked donor-acceptor molecules.** Bolton, J.R.; Weedon, A.C.; Stillman, M.J. (Univ. of Western Ontario, London). Nov 1984. NTIS, PC A10/MF A01. File Number DE85005094. (CONF-8406218—Absts.).

From 8. DOE solar photochemistry research conference; Lake Geneva, WI, USA (11 Jun 1984).

In an attempt to simulate the primary energy conversion step in photosynthesis, the intramolecular photochemical electron transfer reactions have been studied in a series of linked donor-acceptor molecules. A tritolyl porphyrin linked to a $\beta$-cyclodextrin through an ester linkage to one of the primary hydroxyl groups on the $\beta$-cyclodextrin was synthesized to investigate how the redox potential of the acceptor affects the ability of a slinked donor-acceptor to form a stabilized radical ion pair. The study also presents measurements on linked donor-acceptor molecules of the polarized EPR signal from the triplet using transient detection of the polarization decay to map out the EPR spectrum. The results show that as the redox potential of the acceptor becomes more negative, the intensity of the EPR signal drops in a manner similar to a Nerst curve. 3 references.

46279 (ANL—84-95, pp 11-16) **Modulation of optical, spin, and redox properties of chlorophylls by their environment: a theoretical approach.** Hanson, L.K. (Brookhaven National Lab., Upton, NY). Nov 1984. NTIS, PC A10/MF A01. File Number DE85005094. (CONF-8406218—Absts.).

From 8. DOE solar photochemistry research conference; Lake Geneva, WI, USA (11 Jun 1984).

A major emphasis of the porphyrin program has been to characterize the active species involved in the primary electron transfer steps of photosynthesis. The theoretical portion of this program augments the experimental studies by rationalizing existing data and providing guidelines for future experiments. Chang and coworkers have demonstrated that modification of the carbonyl substituents of metalloporphyrins (P), chlorins (C), and bacteriochlorins (BC) to protonated Schiff's bases can lead to dramatic red shifts of the long wavelength absorption bands and that these red shifts can be modulated by the solvent and counterion (i.e., the environment). Calculations by a spectroscopic INDO method on the model P, C, and BC complexes satisfactorily account for the effects of substituent site, ring reduction, and solvent and counterion upon the optical spectra. In addition, they are consistent with resonance Raman and cyclic voltammetry data. These studies have been extended to Schiff's bases of Chl a and BChl a and b. Optical spectra of the unoxidized species were calculated by the INDO-CI method, unpaired spin densities of the radical $\pi$ cations by the extended Hueckel method. Two isomeric forms can be written for the C9 derivatives, ketimine and enamine. The calculations indicate that protonation at this position may induce isomerization from the ketimine to the protonated enamine. In addition, protonation of Schiff's base derivatives of the C2 acetyl of BChls is predicted to cause significant red shifts. The magnitude of the optical shifts of both the C9 and the C2 derivatives should also be sensitive to counterion and solvent effects. P680 is the only primary donor which is more difficult to oxidize than the isolated pigment in vitro. Both computational methods predict the protonated ketimines to be more difficult to oxidize than the parent (B)Chl molecules.

46280 (ANL—84-95, pp 17-23) **Structural requirements for efficient photoinduced charge separation in artificial and natural photosynthetic systems.** Wasielewski, M.R.; Niemczyk, M.P.; Gast, P.; Norris, J.R. (Argonne National Lab., IL). Nov 1984. NTIS, PC A10/MF A01. File Number DE85005094. (CONF-8406218—Absts.).

From 8. DOE solar photochemistry research conference; Lake Geneva, WI, USA (11 Jun 1984).

Covalently linked electron donor-acceptor molecules have become increasingly important in the study of photoinduced electron transfer processes designed to mimic natural photosynthesis. In most of these models the simple linkages between the electron donor and the electron acceptor allow both the distance and the orientation between the donor and the acceptor to vary widely. Those few models in which donor-acceptor geometry is restricted still possess several single bond rotations that add uncertainty to both the distance and the orientation. Studies of model systems possessing well defined donor-acceptor distances and geometries are necessary to fully understand the critical role of these parameters in determining the efficiency of photoinduced charge separation. To facilitate these studies, the six new donor-acceptor models have been synthesized. The center-to-center donor-acceptor distances as determined by space-filling molecular models are 10, 10.5, and 11 A for TPPBQ, TPPNQ, and TPPAQ, respectively. The porphyrin and the quinone both exhibit redox potentials and optical absorbance spectra that are indicative of little or no interaction between the ground state of the porphyrin with that of the quinone. Fluorescence emission yields and lifetimes indicate that the lowest excited singlet stage of the porphyrin in these molecules is highly quenched. The dependence of the fluorescence quantum yield of the porphyrin on the sum of the oxidation potential of the porphyrin and the reduction potential of the quinone suggests that this quenching mechanism is electron transfer. In order to prove this hypothesis, the transient excited state absorption spectra of these compounds following picosecond laser excitation have been determined.

46281 (ANL—84-95, pp 24-26) **ESR and ENDOR study of photoexcited triplets of porphyrins.** van Willigen, H.; Chandrashekar, T.K.; Ebersole, M.H. (Univ. of Massachusetts, Boston). Nov 1984. NTIS, PC A10/MF A01. File Number DE85005094. (CONF-8406218—Absts.).

From 8. DOE solar photochemistry research conference; Lake Geneva, WI, USA (11 Jun 1984).

It is generally accepted that a pair (the so-called special pair) of bacteriochlorophyll (BChl) molecules serves as the primary electron donor in reaction centers of photosynthetic bacteria. Dimers also may play a role in the primary photophysical events in green plants. Unfortunately, in many cases definitive structural models cannot be derived from the spectroscopic data because of a lack of a thorough understanding of the effect of aggregate formation on magnetic resonance parameters. For instance the zero field splitting (zfs) parameters of the photoexcited triplets of (in vivo) reaction centers in photosynthetic bacteria deviate significantly from those found for (in vivo) monomer BChl triplets. A better understanding of dimerization induced changes in zfs values can be obtained with studies of model systems of relatively well defined structure. This study investigates the triplet ESR spectra of some water soluble free base porphyrins (P) and metalloporphyrins (MP). The molecules of interest form dimers as the ionic strength of the solution is increased. Hence, they offer a good opportunity to study the effects of dimerization on triplet characteristics (zfs values, magnetophotoselection effects, kinetics of triplet formation and decay) in a high dielectric constant medium. Data were obtained on the homo dimers ($P_2$) and ($MP_2$) as well as the heterodimers (P.MP). Included in the study was a tetraphenylporphyrin molecule with crown ether moieties fused to the phenyl rings (TCP). Dimerization of TCP can be induced by addition of cations. The triplet characteristics of the water soluble porphyrins differ appreciably from the TCP dimer and previously studied covalently-linked dimers. Possible reasons for the observed differences are discussed.

46282 (ANL—84-95, pp 27-33) **Structure and function relationships in chemical and genetic variants of bacterial photosynthetic reaction centers.** Bowman, M.K.; Budil, D.E.; Lin, C.P.; Kolaczkowski, S.; Kostka, A.G.; Tang, J.; Wasielewski, M.R.; Norris, J.R. (Argonne National Lab., IL). Nov 1984. NTIS, PC A10/MF A01. File Number DE85005094. (CONF-8406218—Absts.).

From 8. DOE solar photochemistry research conference; Lake Geneva, WI, USA (11 Jun 1984).

The study of bacterial photosynthesis has great significance for solar energy conversion research because the photosynthetic unit is a highly efficient functioning system. Different bacteria have different reaction centers. Each type of reaction center represents a slightly different solution that bacteria have found to the problem of solar energy conversion. Electron transfer and energy conversion in bacterial reaction centers can be studied and characterized by a variety of methods and parameters, e.g., EPR, optical absorption, RYDMR, rate constants, quantum efficiencies, etc. Comparisons of reaction centers from different genera and species and of reaction centers altered chemically or genetically will show what parameters are essential for efficient operation and which can be used for fine tuning. Such an investigation is undertaken in three ways. The electron spin echo envelope modulation (ESEEM) is being used to characterize the donors and acceptors in several reaction center systems. The exchange and dipolar interactions and the rate constants measured in RYDMR experiments on reaction centers are a second area of study. The third approach is the careful investigation of the carotenoid function in a single species of bacteria in which the carotenoid is genetically altered or is absent.

46283 (ANL—84-95, pp 34-40) **Surface and optical properties of chlorophyll in model systems.** Leblanc, R.M. (Universite du Quebec, Trois-Rivieres). Nov 1984. NTIS, PC A10/MF A01. File Number DE85005094. (CONF-8406218—Absts.).

From 8. DOE solar photochemistry research conference; Lake Geneva, WI, USA (11 Jun 1984).

The use of model systems arises from the desire to make in vitro structures which have the advantages that their composition is precisely known and that they can be made with macroscopic areas. It is possible to have a degree of control over a model

system which cannot generally be achieved with a real membrane. In order to study the relevant photophysical and photochemical reactions performed by thylakoid membranes in photosynthesis, it is necessary to design specific molecular assemblies. Considering the importance of chlorophyll a (chl a) in photosynthesis, it is mandatory to have a good knowledge of the way this pigment can interact with its environment. The monolayer technique is employed to obtain accurate data on the interactions prevailing between chl a and its lipid environment, for example monogalactosyldiacylglycerol (MGDG) and phytol. MGDG was chosen as a model component of the class of lipids found in the thylakoid membranes. The surface pressure isotherms of mixtures of chl a with MGDG, covering the whole range of molar fractions, have been carefully measured at the air-water interface. The excess free energies of interaction have been calculated from the surface pressure isotherms. Also under study are some chl a - pigment mixtures, e.g. chl a-pheophytin a, chl a - chl b and chl a - carotenoid. More biologically relevant systems are being investigated by studying how these interactions are modified when proteins are dissolved in the subphase and come into contact with the chl a molecules dispersed in a mixed monolayer at the interface. Mono- and multilayers of pure chl a, chl a - lipid, chl a - protein and chl a - pigment have been prepared by means of the Blodgett-Langmuir technique for electronic, infrared, emission, photoacoustic and photovoltaic studies. The nature of the interaction of chl a in the different systems is examined.

**46284** (ANL—84-95, pp 41-45) **Triplet states of chlorophylls.** Clarke, R.H. (Boston Univ., MA). Nov 1984. NTIS, PC A10/MF A01. File Number DE85005094. (CONF-8406218—Absts.).

From 8. DOE solar photochemistry research conference; Lake Geneva, WI, USA (11 Jun 1984).

Using ODMR (optically detected magnetic resonance) and resonance Raman spectroscopy, the photoexcited triplet states of chlorophylls were investigated. The study determined photoexcited triplet state zero-field splittings, overall triplet lifetimes, and individual spin sublevel intersystem crossing rate constants at 2k for chlorophylls in organic solvents, in monolayer and multilayer assemblies, in synthetic protein complexes, and in naturally occurring chlorophyll-containing units extracted from in vivo systems. Chlorophyll interactions with graphite surfaces, particularly crystalline (HOPG) graphite, have been studied using ODMR and resonance Raman spectroscopy. These results indicated that single-layer coverage of graphite with chlorophylls can be detected spectroscopically to facilitate the monitoring of molecular parameters. These experiments are continuing with the goal of determining orientational features of the chlorophyll ring system relative to the graphite conducting surface. 5 references.

**46285** (ANL—84-95, pp 46-51) **Energy conversion processes based on molecular excited states.** Meyer, T.J. (Univ. of North Carolina, Chapel Hill). Nov 1984. NTIS, PC A10/MF A01. File Number DE85005094. (CONF-8406218—Absts.).

From 8. DOE solar photochemistry research conference; Lake Geneva, WI, USA (11 Jun 1984).

Photophysical and photochemical properties of a series of metal to ligand charge transfer (MLCT) excited states, and their applications in energy conversion processes are investigated. Detailed quantum yield, emission spectra, and lifetime experiments have been revealing as to the photophysical and photochemical events which control the observed excited state properties in a series of MLCT excited states based on Os(II), Ru(II), Re(I), and Mo(O). As a result of a systematic series of synthetic studies, it has been possible to prepare a series of chromophores which lead to excited states with varying and systematically controllable excited state redox potentials. The electron transfer properties of this class of excited states are well defined as shown by the results of emission quenching and flash photolysis studies. It has been possible to devise a series of excited state photoelectrochemical cells based on excited state electron transfer quenching. Synthetic studies have also been extended to metal alkyl and hydrido complexes based on complexes containing either Ru(II) or OS(II) and polypyridyl ligands. In addition, progress has been made towards the end of incorporating examples of this class of chromophore into soluble polymers and into polymeric films on electrode surfaces.

**46286** (ANL—84-95, pp 52-56) **Photochemical energy conversion and solution kinetics.** Creutz, C.; Netzel, T.; Sutin, N. (Brookhaven National Lab., Upton, NY). Nov 1984. NTIS, PC A10/MF A01. File Number DE85005094. (CONF-8406218—Absts.).

From 8. DOE solar photochemistry research conference; Lake Geneva, WI, USA (11 Jun 1984).

A number of transition metal complexes are excellent mediators of outer-sphere light-induced redox reactions, many of which effect net storage of the light energy. In addition, because of their ability to promote the formation or activation of small molecules, transition metal complexes can provide homogeneous catalytic routes for the thermal and photochemical formation of $H_2$ or activation of $CO_2$. Since efficient light conversion and storage require the diversion of a significant fraction of the electronically excited molecules into useful reactions which must be driven in competition with rapid physical deactivation processes and chemical back-reactions, a major objective of this program is the quantitative study and control of these physical and chemical deactivation processes. Because the overall efficiency of the conversion sequence is determined by the nature and rate of the subsequent chemical steps, mechanistic studies of the reactions of transition metal ions in high and low oxidation states are also a major focus of the program. The mechanism of the Co(II)-catalysis of oxygen formation from $Ru(bpy)_3^{3+}$ and water has been deduced from kinetic studies of the system at natural pH. These kinetics show that Co(IV) is the crucial intermediate in the catalysis. At pH 7, 25°C, the rate of product formation is proportional to $[Ru(III)]^2$ [Co(II)]/[Ru(II)] where Ru(III) and Ru(II) denote the Ru(bpy)s/sup n+/ complexes.

**46287** (ANL—84-95, pp 57-59) **Intramolecular energy transfer reactions in polymetallic complexes.** Peterson, J.D. (Clemson Univ., SC). Nov 1984. NTIS, PC A10/MF A01. File Number DE85005094. (CONF-8406218—Absts.).

From 8. DOE solar photochemistry research conference; Lake Geneva, WI, USA (11 Jun 1984).

This research concentrates on the preparation, characterization, and photochemistry of polymetallic complexes each containing three integral parts. One metal center is a highly-absorbing, but photochemically non-reactive (antenna fragment), a second metal center (reactive fragment) undergoes a useful chemical reaction, and the third component is a highly-communicative bridging ligand which effectively couples the two metal fragments. Some of the advantages in using such a system for energy conversion processes are that the reacting system does not have to absorb visible light, and the inherent inefficiency of the bimolecular quenching process in an intermolecular energy-transfer reaction can be circumvented. Previous model studies have indicated that very short highly-unsaturated bridging ligands are necessary to allow the intramolecular energy transfer to be competitive with non-radiative deactivation. A second concern in system development is the resiliency of the metal-bridging ligand bonds. For these reasons, the systems discussed involve chelate bridging ligands, such as 2,2'-bipyrimidine (bpym), 2,2'-biimidazolate (BiIm) and its diphenyl (BiBzIm) and tetracyano (TcBiIm) derivatives.

**46288** (ANL—84-95, pp 60-65) **Photophysical effects of metal-carbon sigma bonds in transition metal complexes.** Watts, R.J. (Univ. of California, Santa Barbara). Nov 1984. NTIS, PC A10/MF A01. File Number DE85005094. (CONF-8406218—Absts.).

From 8. DOE solar photochemistry research conference; Lake Geneva, WI, USA (11 Jun 1984).

Coordination of second and third row transition metals to aromatic N-coordinating chelates leads to a variety of complexes with photochemical and photophysical properties which render them suitable as photosensitizers. The photophysical properties of dichloro-bridged dimers of the type $[ML_4Cl]_2$ where M=Rh(III), Ir(III) and L=ppy (2-phenylpyridine), bzq (benzo[h]quinoline) have been studied. The large effects of metal-carbon bonding are illustrated by comparison of $[Rh(ppy)_2Cl]_2$, which emits in the blue region from a ligand-localized excited state, with $Rh(bpy)_2Cl_2^+$, which emits in the red region from a ligand-field excited state. This behavior results from the enhanced d-orbital splitting induced by Rh-C bonding in the ppy complex relative to Rh-N bonding in the bpy complex. The analogous Ir(III) complex of ppy emits from a

charge-transfer excited state, both at 77K in rigid glasses and at 295K in fluid solutions. The emission of this complex is quenched by electron acceptors such as nitrobenzene, indicating its potential as a photoreductant. Its emission energy indicates that the charge-transfer excited state is lower in energy than that of $Ir(bpy)_2Cl_2^+$. These results indicate that ppy both raises the energy of ligand-field excited states and lowers the energy of charge-transfer excited states relative to similar complexes of metal-N bonded bpy.

46289 (ANL—84-95, pp 66-70) **Charge localization, spin multiplicity, and symmetry of electronically excited tris(2,2'-bipyridine)ruthenium(II) dichloride.** Philips, L.A.; Brown, W.T.; Webb, S.P.; Yeh, S.W.; Clark, J.H. (Lawrence Berkeley Lab., CA). Nov 1984. NTIS, PC A10/MF A01. File Number DE85005094. (CONF-8406218—Absts.).

From 8. DOE solar photochemistry research conference; Lake Geneva, WI, USA (11 Jun 1984).

Transition metal complexes (TMC) display a rich and varied photochemistry which has found broad application in a wide range of solar energy conversion processes. Although tris(2,2'bipyridine)ruthenium(II) dichloride ($Ru(bpy)_3^{2+}$) has been extensively studied, many details of its excited-state dynamics are as yet unresolved. What is the nature of the charge localization process in electronically excited $Ru(bpy)_3^{2+}$? Does the charge localization occur simultaneously with, or subsequent to, electronic excitation? What are the symmetries of the absorbing and emitting species? Are there distinguishable singlet and triplet MLCT excited states, and, if so, what are the rates of intersystem crossing? In the present study, these questions are addressed via direct observation of electronically excited $Ru(bpy)_3^{2+}$ using picosecond $TR^3$ (time-resolved resonance Raman spectroscopy) and picosecond time-resolved emission spectroscopy. 7 references.

46290 (ANL—84-95, pp 71-75) **Picosecond spectroscopic studies of the photochemistry of metal complexes and organometallic compounds.** Netzel, T.; Creutz, C.; Sutin, N. (Brookhaven National Lab., Upton, NY). Nov 1984. NTIS, PC A10/MF A01. File Number DE85005094. (CONF-8406218—Absts.).

From 8. DOE solar photochemistry research conference; Lake Geneva, WI, USA (11 Jun 1984).

Excited states of metal complexes and organometallic compounds are finding increasing application in the design of solar energy conversion systems and the synthesis of useful chemical products. This program is directed toward fundamental studies of the reactions of excited states of metal complexes and organometallic compounds. A major objective of this program is the quantitative study of the factors determining the photophysical and photochemical processes in these complexes. Thus lifetimes and spectra of excited states and intermediates are being measured, and their rates of reaction are being determined and modelled. The lifetimes of the ligand-to-metal charge-transfer (LMCT) excited states produced by 527 nm excitation of $M(phen)_3^{3+}$ and $M(bpy)_3^{3+}$ (M = Fe or Os; phen = 1,10-phenanthroline; bpy = 2,2'-bipyridine) were measured between 10 and 295 K and were compared to the low-temperature lifetimes of the metal-to-ligand charge-transfer (MLCT) excited states of the corresponding $M(phen)_3^{2+}$ and $M(bpy)_3^{2+}$ complexes. The observations that the MLCT states of the osmium(II) complexes are $10^5$-$10^6$ times longer-lived than the LMCT states of the osmium(III) complexes (microseconds vs. picoseconds) and that the lifetimes of both types of CT states are increased by less than a factor of 3 upon deuteration were rationalized in terms of radiationless decay theory. The dominant active modes for both types of CT states appear to be intermediate frequency (1300-1600 $cm^{-1}$) vibrations and it is proposed that the shorter lifetimes of the osmium(III) complexes are mainly a consequence of their smaller energy gaps.

46291 (ANL—84-95, pp 76-83) **Effects of free energy on rates of electron transfer.** Miller, J.R.; Closs, G.L.; Calcaterra, L.T.; Penfield, K.; Huntoon, A. (Argonne National Lab., IL). Nov 1984. NTIS, PC A10/MF A01. File Number DE85005094. (CONF-8406218—Absts.).

From 8. DOE solar photochemistry research conference; Lake Geneva, WI, USA (11 Jun 1984).

Theory has long predicted a relationship between the kinetics and thermodynamics of electron transfer (ET) in which the ET rates decrease with increasing exothermicity for highly exothermic reactions. The relationship is now confirmed for reactions of two types: $D.^- + A \rightarrow D + A.^-$ and $D^* + A \rightarrow D.^+ + A.^-$. ET from radical anions (reaction 1) was measured in fluid solutions at room temperature by pulse radiolysis using bifunctional molecules of the type D-Sp-A and in a rigid glass at low temperature. In the bifunctional molecules, D and A are $\pi$ molecular groups (aromatics and quinones) and Sp is the rigid molecular spacer androstane. The spacer holds the nearest edges of the D and A groups 10 A apart. The rate vs. energy relationship for these molecules in MTHF at 296K peaks at ~1.2 eV and is well described by conventional ET theories with reorganization energies for the solvent and for molecular vibrations of $\lambda/sub\ s/ = 0.75$ eV and $\lambda/sub\ s/ = 0.45$ eV respectively. Very similar reorganization energies were found for intermolecular ET in MTHF glass at 77K. These experiments have shown that ET theories may in fact give a reasonable description of the effect of exothermicity on ET rates, despite the preponderance of experimental data in the literature which seemed to contradict the theories.

46292 (ANL—84-95, pp 84-88) **Photochemical/latent heat storage based on benzenoid materials.** Childs, R.F. (McMaster Univ., Hamilton, Ontario). Nov 1984. NTIS, PC A10/MF A01. File Number DE85005094. (CONF-8406218—Absts.).

From 8. DOE solar photochemistry research conference; Lake Geneva, WI, USA (11 Jun 1984).

In contrast to the photochemistry of the benzenoids themselves, the protonated benzenes, or benzenium cations, undergo efficient photoreactions to yield the corresponding bicyclic cations. The thrust of this present project is to try and utilize these very clean photoreactions in order to carry out an acid catalyzed transformation. The acid catalyst necessary for the photoreactions would be a heterogeneous acid which would be located in the solar collector. The reverse thermal isomerization of the bicyclic product to the starting benzene can be readily catalyzed. A variety of compounds can be considered as potential candidates for such a storage system. Results are given here of a detailed examination of the tetra- and pentamethylphenols. These phenols are photochemically inert when irradiated in conventional solvents. In triflic acid solutions the phenols exist as the C-protonated cations. When irradiated with light of wavelength greater than 300 nm these cations isomerize to the protonated bicyclo[3.1.0]hexenones. In each case a photostationary state is reached which can be approached from either direction. Substantial amounts of the protonated bicyclic ketones are present in these mixtures. The quantitative aspects of these isomerizations have been examined. Typically the quantum efficiencies are high. The product ketones are thermodynamically stable at ambient temperatures yet undergo clean, acid catalyzed isomerizations to the phenols at higher temperatures (>60°C). The enthalpy differences between the various compounds and cations have been determined.

46293 (ANL—84-95, pp 89-93) **Energetics of illuminated semiconductor-electrolyte interfaces.** Nozik, A.J.; Thacker, B.; Turner, J.A. (Solar Energy Research Institute, Golden, CO). Nov 1984. NTIS, PC A10/MF A01. File Number DE85005094. (CONF-8406218—Absts.).

From 8. DOE solar photochemistry research conference; Lake Geneva, WI, USA (11 Jun 1984).

Studies of hot electron injection reactions at semiconductor-electrolyte interfaces were extended in two different types of p-InP systems. In one system, supraband-edge reduction reactions were conducted in acetonitrile with the reversible redox couple, cobaltocene/cobaltocinium. The effects of producing a negatively charged redox species on band-edge movement were studied; the results indicated that band-edge movement did not interfere with the hot electro injection process. The experiments showed that hot electron reduction of cobaltocene could be achieved similarly to the previous results with p-nitrobenzonitrile. The second system investigated is $H_2$ evolution on p-InP in aqueous electrolyte. A theoretical model was developed for the electrode kinetics of $H_2$ evolution that predicts current-voltage characteristics, taking into account hot carrier processes. The basic assumption of the model is that electrons injected into the electrolyte via a non-thermalized pathway do not populate surface states. The model takes into account bulk diffu-

sion, surface and bulk recombination, band-edge movement through surface state charging, hot electron distribution functions, and redox levels and energy distribution functions. The current-voltage characteristics are calculated as a function of doping density. The analysis shows that at high doping levels, where hot carrier effects become important, the photocurrent begins at lower band bending and exhibits a unique potential dependence.

46294 (ANL—84-95, pp 94-97) **Solar energy utilization for waste treatment.** Langford, C.H.; Carey, J.H. (Concordia Univ., Montreal, Quebec). Nov 1984. NTIS, PC A10/MF A01. File Number DE85005094. (CONF-8406218—Absts.).

From 8. DOE solar photochemistry research conference; Lake Geneva, WI, USA (11 Jun 1984).

A major barrier to development of solar photochemical technologies is the lack of engineering experience. In order to launch solar photochemistry onto a technological learning curve, applications very much less economically challenging than large scale fuel formation are needed. The approach presented here draws inspiration from the demonstrably economic ultraviolet disinfection scheme discussed by Oliver and Carey and recent pilot experiments on photooxidation of gold mine wastes and looks toward application of photocatalysts to pollution abatement and hybrid photochemical-microbiological energy storage. Thus, heterogeneous photocatalysts are studied. The program has three aspects: 1) study of conditions for irreversibility of initial steps using flash photolysis; 2) examination of sensitizers for semiconductors; and 3) useful reaction pathways. 8 references.

46295 (ANL—84-95, pp 98-104) **Photochemical energy storage: studies of inorganic photoassistance agents.** Wrighton, M.S. (Massachusetts Institute of Technology, Cambridge). Nov 1984. NTIS, PC A10/MF A01. File Number DE85005094. (CONF-8406218—Absts.).

From 8. DOE solar photochemistry research conference; Lake Geneva, WI, USA (11 Jun 1984).

Light-driven redox chemistry at electrode/electrolyte interfaces is the theme of research carried out in this research program. Fundamental studies of semiconductor photoelectrodes and electrode-confined catalysts are under way in connection with the long-term objective of uncovering the principles and possible opportunities associated with the conversion of optical energy to electrical and/or chemical energy. Studies include photoelectrochemical reduction of aqueous $CO_2$ and characterization of redox polymer/metal electrocatalysts.

46296 (ANL—84-95, pp 105-108) **Surface-modified semiconductor electrodes.** Frank, A.J. (Solar Energy Research Institute, Golden, CO). Nov 1984. NTIS, PC A10/MF A01. File Number DE85005094. (CONF-8406218—Absts.).

From 8. DOE solar photochemistry research conference; Lake Geneva, WI, USA (11 Jun 1984).

The instability of narrow-bandgap semiconductors to oxidative photodegradation and the poor catalytic properties of the semiconductor surface for many chemical reactions of importance are major scientific obstacles to the development of a practical photoelectrochemical solar cell. This research program addresses the fundamental problems of the photoinstability of n-type semiconductors and the high overpotential associated with specific chemical reactions such as the oxidation and reduction of water. The experimental approach involves modifying the semiconductor surface with highly conductive polymers incorporating catalytically active metal centers. The rationale behind this approach is that the combination of conductive polmer and catalyst provides a mechanism for the rapid removal and trapping of photogenerated charges from the semiconductor and the catalysis of desirable redox reactions. A major-effort has been the characterization of surface-modified single-crystal CdS diodes with respect to the photolysis of water. The surface modification involved coating the faces of CdS with polypyrrole and polystyrene films containing catalytic dispersions of transition metals (Pt, Rh, $RuO_2$). Complementary information on the diodes was obtained from electrochemical studies of surface-modified graphite electrodes.

46297 (ANL—84-95, pp 109-112) **Photoelectrochemistry of organic dyes.** Spitler, M.T. (Mount Holyoke College, South Hadley, MA). Nov 1984. NTIS, PC A10/MF A01. File Number DE85005094. (CONF-8406218—Absts.).

From 8. DOE solar photochemistry research conference; Lake Geneva, WI, USA (11 Jun 1984).

The primary concern of this research program is the investigation of the current produced by excited organic dyes adsorbed at the surface of semiconductor electrodes. Under study is the photooxidation of cyanine and xanthene dyes present in monolayer and submonolayer concentrations at the surface of $TiO_2$, $SrTiO_3$, and ZnO single crystal surfaces. The photocurrent produced is a function of the photophysics of the dye molecule as well as of the relative energetics of its excited state and the semiconductor condition band edge. It can best be analyzed in terms of the quantum efficiency for current production, phi/sub p/, where phi/sub p/ is the number of electrons drawn off as current per photon absorbed. For these single crystal surfaces phi/sub p/ remains about $10^{-2}$ for the monomer form of all dyes. The intent of this work has been to obtain insight into the grounds for this low efficiency. Two applications of total internal reflection of light have been employed to obtain phi/sub p/. One uses the attenuated total reflection of a laser beam (ATR) within the electrode to measure phi/sub p/ at specific wavelengths. The other uses internally reflected white light (IRS) to obtain the complete visible spectrum of the adsorbed dye layer. These spectra can be compared easily with photocurrent action spectra of the same system.

46298 (ANL—84-95, pp 112-115) **Photoelectrochemical sensitization on polymer-coated electrodes.** Fox, M.A.; Kamat, P.V.; Britt, P. (Univ. of Texas, Austin). Nov 1984. NTIS, PC A10/MF A01. File Number DE85005094. (CONF-8406218—Absts.).

From 8. DOE solar photochemistry research conference; Lake Geneva, WI, USA (11 Jun 1984).

Photoresponsive polymer-coated semiconductor electrodes can be prepared by electropolymerization of a monomer containing a pendant chromophore or electrophore. Materials are produced containing high concentrations of the photoelectroactive sensitizer in the critical interfacial region between the semiconductor surface and the liquid electrolyte. For this investigation, n-type tin oxide and titanium oxide semiconductor electrodes have been coated with a series of anthryl modifed polymers. Surface spectroscopy and Fourier transform infrared spectroscopy have been used for structural characterization of the modified surfaces. Using a solution dip-solvent evaporation procedure, poly-4-vinylpyridine coated $SnO_2$ surfaces have been prepared. By controlling the pH of an aqueous electrolyte, either anionic or cationic species can be complexed. These surface modifications insignificantly alter the kinetics of electrooxidation of redox couples present in the electrolyte. A mechanistic study of the means of facilitation of electron transport through the polymer layer is discussed. Photoelectrochemical effects can also be observed with these designed polymer electrodes. Evidence is presented that these absorptive coatings can mediate electron transfer between the electrode surface and a dissovled redox couple. Application of these principles for the construction of a photogalvanic electrochemical cell is also covered.

46299 (ANL—84-95, pp 116-120) **Sputtered semiconductor films for solar energy conversion.** Weber, M.F.; Schumacher, L.C.; Sasseville, R.L.; Mamiche-Afara, S.; Dignam, M.J. (Univ. of Toronto, Ontario). Nov 1984. NTIS, PC A10/MF A01. File Number DE85005094. (CONF-8406218—Absts.).

From 8. DOE solar photochemistry research conference; Lake Geneva, WI, USA (11 Jun 1984).

This research project is aimed at assessing the prospects of developing thin film elements for efficient photoelectrolysis of water using atomic sputtering as the principle fabrication technique. To this end extensive efficiency analysis has been performed based on a variety of configurations, and a systematic study has been done of the conditions required to produce films of good solid state properties by atomic sputtering. These studies also include some work on the effects of very thin overcoatings on the properties of the semiconductor, electrolyte junction. 3 references.

46300 (ANL—84-95, pp 121-123) **Ultra high vacuum electrochemistry and photoelectrochemistry with conducting polymers.** Skotheim, T.A. (Brookhaven National Lab., Upton, NY). Nov 1984. NTIS, PC A10/MF A01. File Number DE85005094. (CONF-8406218—Absts.).

From 8. DOE solar photochemistry research conference; Lake Geneva, WI, USA (11 Jun 1984).

Solid polymer electrolytes based on high molecular weight poly(ethylene oxide) (PEO) complexed with alkali metal salts have been studied as electrolytes in ultra high vacuum (UHV) electrochemical cells and in photoelectrochemical cells based on junctions with n-type semiconductors.

46301 (ANL—84-95, pp 124-129) **Photoinduced electron transfer employing new dithioether electron relays and organic dyes bound to amphiphilic polymers.** Jones, G. II. (Boston Univ., MA). Nov 1984. NTIS, PC A10/MF A01. File Number DE85005094. (CONF-8406218—Absts.).

From 8. DOE solar photochemistry research conference; Lake Geneva, WI, USA (11 Jun 1984).

Areas of study include developing new relays or charge carriers for photoinduced electron transfer, investigation of one- vs. two-electron reducing agents, new sensitizing media involving bound organic dyes, and the photochemistry of charge-transfer complexes. Two of these project areas are 1,5-Dithiacyclooctane (DTCO): a prototype electron donor which is reversibly sacrificial and unusual photophysics and photochemistry of crystal violet (CV) bound to polyacrylic acid (PAA).

46302 (ANL—84-95, pp 130-134) **Charge transfer photochemistry in bipyridinium salts and reactivity of the products.** Ebbesen, T.W. (Univ. of Notre Dame, IN). Nov 1984. NTIS, PC A10/MF A01. File Number DE85005094. (CONF-8406218—Absts.).

From 8. DOE solar photochemistry research conference; Lake Geneva, WI, USA (11 Jun 1984).

Considerable attention has been paid to the photosensitized reduction of bipyridinium salts as a potential mechanism of solar energy conversion. Irradiation of bipyridinium halide (and pseudohalide) charge transfer complexes generates directly strong reducing and oxidizing species with quantum yields that are comparable to the photosensitized pathways. The reactivity of the species generated is also being studied to find useful products for long term storage. The initial efforts have concentrated on the photochemistry of 1,1'-dimethyl-4,4'-bipyridinium salts (better known as paraquat or methyl viologen) or $MV^{2+}(X^-)_2$ where $X^-$: $Cl^-$, $Br^-$, $I^-$ and $SCN^-$. The electron deficient bipyridinium moeity will form ground state charge transfer complexes with the counter ions. Upon excitation of the di-anion charge transfer complexes, MV/sup +./ and X/sup -./ are generated with a quantum yield of 0.2 when $X^-$ is $Cl^-$ or $SCN^-$[2] and less than 0.01 when $X^-$ is $Br^-$ or $I^-$. Picosecond flash photolysis of the thiocyanate complexes reveal that upon excitation both the mono-anion and the di-anion complexes undergo intra-complex charge transfer with an observed quantum yield of 0.4. However the radical pair (MV/sup +./X/sup ./) formed from the mono-anion complex undergoes complete geminate recombination while ca. 50% of the radical pairs (MV/sup +./X/sup -./$_2$) resulting from the di-anion complex escapes geminate recombination by diffusional separation of MV/sup +./ and X/sup -./$_2$.

46303 (ANL—84-95, pp 135-141) **Polyelectrolytes and colloids as interfaces for retarding back-electron transfer.** Otvos, J.W.; Casti, T.E.; Calvin, M. (Lawrence Berkeley Lab., CA). Nov 1984. NTIS, PC A10/MF A01. File Number DE85005094. (CONF-8406218—Absts.).

From 8. DOE solar photochemistry research conference; Lake Geneva, WI, USA (11 Jun 1984).

Negatively charged surfaces such as silica colloids and micelles were effective in retarding the back-reaction between the primary products of some photoinduced electron transfer reactions. To generalize this effect work is continuing with other surfaces, in particular a negatively charged polyelectrolyte, polystyrene sulfonate (PSS). This material is more versatile than silica colloids are in the pH regime that can be applied because of the low pK/sub a/ of its sulfonate groups. Like silica, the PSS tightly binds the positively charged sensitizer that is used, zinc tetramethylpyridyl porphyrin $(ZnTPuP)^{4+}$ and causes the photoreaction to occur adjacent to the polyelectrolyte molecule. The electron acceptor is propylviologen sulfonate PVS)$^0$, an overall neutral, zwitterionic compound. When it is reduced by the sensitizer to form $(PVS^-$ it is expected to be electrostatically repelled from the vicinity of the polyelectrolyte and thereby prevented .rom back-reacting. In steady-state photolysis a sacrificial electron donor such as triethanolamine (TEOA) is used to compete with the back reaction, to drive the reaction forward, and to stabilize the presence of $(PVS)^-$. By flash photolysis in the absence of donor, the formation of $(PVS)^-$ as well as its disappearance by back-reaction can be monitored spectroscopically.

46304 (ANL—84-95, pp 142-149) **Structural aspects of photoinduced charge separation in micellar and vesicular media.** Kevan, L. (Univ. of Houston, TX). Nov 1984. NTIS, PC A10/MF A01. File Number DE85005094. (CONF-8406218—Absts.).

From 8. DOE solar photochemistry research conference; Lake Geneva, WI, USA (11 Jun 1984).

Photoionization can store energy if net charge separation is achieved. Rapid ion recombination back reactions can be significantly slowed down by the utilization of organized molecular assemblies such as micelles and vesicles. This investigation focuses on the structural aspects controlling charge separation. The experimental thrust utilizes electron spin resonance methods to detect the paramagnetic photoproduced cations and to probe their interactions with their surroundings. Net charge separation can be detected by electron spin resonance (ESR) in frozen solutions where the back reactions are inhibited. Photoproduced cation-water interactions and other structural information with regard to the surfactant molecules can be studied by electron spin echo modulation (ESEM) techniques. ESEM enables the determination of weaker electron-nuclear hyperfine interactions than one can normally detect by ordinary cw ESR. Furthermore, the ESEM technique is particularly well adapted to the study of disordered systems as exemplified by micelles and vesicles. To prevent molecular averaging of these interactions these studies must be made in frozen solutions.

46305 (ANL—84-95, pp 150-155) **Mechanisms of photochemical energy conversion by chlorophyll.** Tollin, G.; Ford, W.E.; Fang, Y. (Univ. of Arizona, Tucson). Nov 1984. NTIS, PC A10/MF A01. File Number DE85005094. (CONF-8406218—Absts.).

From 8. DOE solar photochemistry research conference; Lake Geneva, WI, USA (11 Jun 1984).

This investigation focuses on the effects of cholesterol on triplet quenching and radical formation and decay in bilayer vesicles. The quenching of the triplet state of chlorophyll a (Chl) by asymmetrically located electron acceptors was examined in vesicle systems containing egg yolk phosphatidylcholine and 0-50 mole % cholesterol. The incorporation of cholesterol had two main effects: 1) the distribution of Chl within the vesicle wall shifted from one favoring the inner monolayer to one favoring the outer monolayer, and 2) the Chl molecules (both ground and excited states) became more accessible to water and to the quencher molecules. Effects of asymmetric salt ion distributions in electrically charged bilayer vesicles on radical formation and decay are also under study. The presence of relatively low concentrations of counterions (millimolar in the case of univalent ions and micromolar in the case of polyvalent ions) in either the inner or outer aqueous compartments of electrically charged lipid bilayer vesicles containing chlorophyll in the presence of benzoquinone has been shown to produce large effects on radical formation and decay as measured by laser flash photolysis. With negatively charged vesicles having no added salt inside, salt ions added to the external phase caused radical yields to markedly decrease, with no change in decay kinetics. When salt was present only in the interior phase, radical decay became biphasic and the ability of externally added salt to affect radical yields was greatly diminished. These results have been interpreted in terms of electrostatic and structural effects of charge neutralization by counterions on the dynamics of radical-ion separation and recombination.

46306 **(BMFT-FB-T—85-066) Gasification of biomass and utilization of the gas in engines.** Schulze Lammers, P.; Leuchs, M. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.); Bayerische Landesanstalt fuer Landtechnik, Freising (Germany, F.R.); Maschinenfabrik Augsburg-Nuernberg (M.A.N.) A.G., Muenchen (Germany, F.R.). Bereich Neue Technologie). Jul 1985. 75p. (In German). NTIS (US Sales Only), PC A08/MF A01. File Number DE85752703.

Little is known about specific data of counter-current gasifiers, especially concerning the whole system including gas engines and condensate treatment, data of a counter-current gasifier connected with a 125 kWsub(el) engine should be gathered to get technical data and information about ecological and economical problems, measuring devices were installed at the test plant and the data were evaluated with the aid of a computer program. Methods to treat the waste water have been tested in laboratory and technical scale. The economics were evaluated in a model varying several parameters, and the system gasified different biomasses (wood and straw) with an average efficiency of 55%; more humid biomasses showed higher efficiencies (up to 70%). The condensate of the gas cooling process can be handled by burning or biologically. No problems occurred in connection with the engine. The system followed load changes without any difficulties. A device to control the oxygen in the exhaust gas of the engine was tested successfully. The economic evaluation showed, that in Europe positive results are thinkable only in a few cases. The counter-current gasifier for electricity production is possible technically and in an environmentally acceptable way. Today an economically reasonable investment seems to be possible only in developing countries.

46307 **(CONF-8506185—1) Need for standardization in short-rotation energy feedstock research.** Wright, L.L. (Oak Ridge National Lab., TN (USA)). 1985. Contract AC05-84OR21400. 9p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016590.

From 22. annual meeting of the poplar council of the United States; Lawrence, KS, USA (25 Jun 1985).

This paper describes some recommendations for development of reference materials, analytical methodologies, and protocols and standards for production, conversion and end use of biomass. Efforts to apply these recommendations to DOE's Biomass programs, particularly in the area of short-rotation cultivation of woody crops, are discussed.

46308 **(DOE/ER/10701—T2) Progress report on fluorescence spectrophotometers.** Robinson, H. (Illinois Univ., Urbana (USA). Dept. of Physiology and Biophysics). 1985. Contract AC02-80ER10701. 48p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85010686.

This report describes the ongoing development of a portable field double-flash kinetic fluorescence spectrophotometer to be used in the analysis of photosynthetic electron transport processes and in reaction kinetics of photosystem II. 27 refs., 1 fig.

46309 **(DOE/ER/10701—T3) [Photosynthesis in intact plants]. Progress report.** Crofts, A.R. (Illinois Univ., Urbana (USA)). 1985. Contract AC02-80ER10701. 7p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85017619.

Progress is reported on a project to study photosynthesis in intact plants. Involved is the development of a set of laboratory and field apparatus based on similar designs, and a parallel program of laboratory and field based research on the mechanisms of photosynthetic electron transport and energy conservation in chloroplasts and intact plants. Discussion is presented under the headings: the acceptor side of photosystem II in chloroplasts and intact plants; the donor side of photosystem II, and Instrumentation.

46310 **(DOE/ET/20026—T1) Selection of high producing shrubs of the western United States for energy biomass. Reporting period: March 1, 1980-February 28, 1981.** McKell, C.M.; Van Epps, G.A.; Barker, J.R. (Utah State Univ., Logan (USA). Inst. of Land Rehabilitation). [1985]. Contract FG01-78ET20026. 13p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85017603.

This report covers the second year of a three year project. The overall object, was to measure growth of five shrub species in a uniform garden at the Nephi Field Station, Nephi, Utah. The first year of the project seeds were collected from large growing shrubs located throughout the Intermountain West. Seedlings were grown in containers and then outplanted in May and June, 1980. The field design allowed for the influence of plant spacing on growth to be evaluated. After the second growing season, shrubs are not large enough to complete with others. A second objective during the past year was to measure regrowth of shrubs that were harvested two years previous. These shrubs were harvested to determine their biomass under natural conditions. Regrowth of the shrubs was poor. Further research is needed to determine what factors optimize shrub regrowth after harvesting. 2 refs., 1 fig., 3 tabs.

46311 **(DOE/ET/20026—T2) Selection of high producing shrubs of the Western United States for energy biomass. Final report, April 1, 1978-October 31, 1981.** McKell, C.M.; Van Epps, G.A.; Barker, J.R. (Utah State Univ., Logan (USA). Inst. of Land Rehabilitation). 1981. Contract FG01-78ET20026. 86p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE85017604.

This project investigated the selection and preliminary study of the most productive native shrubs that are commonly found growing on millions of acres of arid and semiarid lands of the Western United States for their potential use as energy fuel from biomass. Many uncertainties exist in producing biomass for energy fuels. However, arid land shrub biomass production offers several advantages that may be more favorable than other biomass types. Shrubs could utilize available marginal croplands and rangelands; there would be little or no competition for scarce water resources, and within the wide diversity of native shrubs, a number of species have a potential for relatively large biomass production. Species chosen for study were fourwing saltbush (Atriplex canescens), big saltbush (A. lentiformis), big sagebrush (Artemisia tridentata), spreading rabbitbrush (Chrysothamnus linifolis), rubber rabbitbrush (C. nauseosus), and greasewood (Sarcobatus vermiculatus). The study was divided into three phases. Phase one dealt with the selection, measurement, and burning quality of large growing shrubs in native populations. The main objective of phase two was to measure the biomass production of the selected large growing shrubs at a dryland field research station for three years. In addition the influence of planting space was ascertained. In phase three the genetic differences of large and small sagebrush (A. tridentata) were evaluated. 15 figs., 24 tabs.

46312 **(DOE/JPL—1012-104) Progress report 24 for the period March 1984 to October 1984 and proceedings of the 24th project integration meeting.** (Jet Propulsion Lab., Pasadena, CA (USA)). 1984. Contract AI01-76ET20356. 643p. (JPL-PUB—85-27; CONF-8410317—Summ.). NTIS, PC A99/MF A01; 1; GPO Dep. File Number DE85017592.

From 24. project integration meeting; Pasadena, CA, USA (2 Oct 1984).

This report describes progress made by the Flat-Plate Solar Array Project during the period March 1984 to October 1984. It includes reports on silicon sheet growth and characterization, silicon material, process development, high-efficiency cells, environmental isolation, engineering sciences, and reliability physics. It includes a report on, and copies of visual presentations made at, the 24th Project Integration Meeting held at Pasadena, California, on October 2 and 3, 1984.

46313 **(DOE/JPL/956766—85/01) Electrical research on solar cells and photovoltaic materials. Final report.** Orehotsky, J. (Wilkes Coll., Wilkes-Barre, PA (USA)). 5 Mar 1985. Contract NAS-7-918-956766. 208p. NTIS, PC A10/MF A01; 1; GPO Dep. File Number DE85016575.

A systematic study of the properties of various polymer pottant materials and of the electrochemical corrosion mechanisms in solar cell materials is required for advancing the technology of terrestrial photovoltaic modules. The items of specific concern in this sponsored research activity involve: (1) kinetics of plasticizer loss in PVB, (2) kinetics of water absorption and desorption in PVB, (3) kinetics of water absorption and desorption in EVA, (4) the electrical properties at PVB as a function of temperature and humidity, (5) the electrical properties of EVA as a function of temperature and humidity, (6) solar cell corrosion characteristics, (7) water ab-

sorption effects in PVB and EVA, and (8) ion implantation and radiation effects in PVB and EVA.

**46314 (DOE/JPL/956786—85/5) Development of high-efficiency solar cells on silicon web. Fifth quarterly progress report, January-March 1985.** Rohatgi, A.; Meier, D.L.; Campbell, R.B.; Rai-Choudhury, P. (Westinghouse Research and Development Center, Pittsburgh, PA (USA)). 15 Jul 1985. Contract NAS-7-100-956786. 33p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85017380.

The objective of this program is to understand and improve web silicon so that high-efficiency web cells can be fabricated using advanced cell design and processing. It is clear that high efficiency is a major attribute that will enhance the large-scale applicability of phtotvoltaic systems. Systems calculations indicate that for very large-scale terrestrial applications, ≧ 15% efficient photovoltaic modules will be required at a cost of ≦ 50c/watt. This implies that ~ 18% efficient cells will be needed at low cost. Dendritic web silicon is a single-crystal silicon ribbon that has great potential for low-cost and high-efficiency solar cells. The loss mechanisms in dendritic web silicon are studied by investigating the electrical activity of twin planes, the role of impurities and defects in web, impurity interaction with twin planes, starting web material quality, and the effect of heat treatment and gettering on web quality. An improved understanding of the above effects should lead to fabrication of ~ 18% efficient web cells with good uniformity. Progress toward the development of high-efficiency solar cells on web silicon is described. Reported here are the results of two solar runs using low-resistivity dendritic web silicon, which were completed this quarter. In addition to fabrication low-resistivity web solar cells, laser beam-induced current (LBIC) and DLTS measurements were done on beveled web surfaces to investigate the twin plane activity as well as the twin plane interaction with the impurity.

**46315 (DOE/OR/21389—5) Northeast regional biomass program. Annual report, August 9, 1983-September 30, 1984.** (CONEG Policy Research Center, Inc., Washington, DC (USA)). 1984. Contract FG05-83OR21389. 35p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85017988.

The goal of this program is to promote the increased use of biomass derived energy in the Northeast region and to build a base of technical information on biomass in the region. Highlights of progress achieved by each state during FY84 are summarized. States included in the program are Connecticut, Delware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont. (DMC)

**46316 (EUR—8215) Investigation on ion implantation as a technique suitable to fabricate high efficiency silicon solar cells. Part II. Ion implanted, laser annealed cell.** Soncini, G.; Zignani, F. (Commission of the European Communities, Luxembourg). 1984. 84p. Commission of the European Communities, Luxembourg.

$n^+/p$ supersaturated solar cells were fabricated by using ion implantation and pulsed laser annealing. With these techniques it is possible to obtain emitters which are doped well beyond the solubility limit and present lower sheet resistivities for equal junction depth. In fact, the cells produced in this way presented a low series resistance, but, the higher the emitter doping was, the lower was the conversion efficiency. Measurements of diffusion length, quantum efficiency and reflectivity allowed us to demonstrate that the supersaturated layers are characterized by high values of the absorption coefficient, which are two orders of magnitude higher than in the low doped silicon (for the wavelength of 0.9 μm). Moreover, reflectivity measurements evidenced a considerable decrease of this parameter for the very high concentration examined. The dramatic increase of the absorption in the emitter region, where it is well known that the collection efficiency is in any case very low, determines a poor short circuit current and consequently a low conversion efficiency of the solar cells.

**46317 (EUR—9125-EN) Mechanism of electron transfer in photosynthetic reaction centres and oxygen evolution by plants.** Evans, M.C.W.; Atkinson, Y.E. (Commission of the European Communities, Luxembourg. Directorate-General for Information, Market and Innovation). 1984. 68p. Commission of the European Communities, Luxembourg. Office of Official Publications of the European Communities.

The research carried out under this contract has been mainly concerned with the identification and characterisation of the electron transport components of photosystem 2 and the oxygen-evolving enzyme complex in plants and algae. Procedures have been developed for the isolation of photosystem 2 on a large enough scale for detailed analysis by electron paramagnetic resonance spectrometry. Photosystem 2 reaction centres have been isolated from Chlamydomonas reinhardtii str. F54-14 which lacks photosystem 1. Preparations with oxygen evolution rates in excess of 1000 moles $O_2$/mg Chl./h which are essentially free of photosystem 1 have been isolated from the cyanobacterium Phormidium laminosum and from higher plant chloroplasts. The electron paramagnetic resonance spectrum of the iron-quinone electron acceptor has been identified for the first time.

**46318 (EUR—9135-EN) Primary and associated reactions studied by submicrosecond absorption and emission spectroscopy.** Duysens, L.N.M.; Bochove, A.C. van; Sonneveld, A. (Commission of the European Communities, Luxembourg. Directorate-General for Information, Market and Innovation). 1984. 12p. Commission of the European Communities, Luxembourg. Office of Official Publications of the European Communities.

The aim of the work was to gain insight in the mechanism of system 2. The primary and associated reactions of system 2 in active spinach chloroplasts were studied by means of submicrosecond emission spectroscopy of chlorophyll a. This method has at the present time the best signal to noise ratio for chloroplasts. For the study of the primary acceptor of purple bacteria, which is analogous to that of system 2, in addition to the luminescence kinetics, the more specific absorption difference spectra were measured. This is possible, because the relative concentration of reaction centers is about 5 times larger than in chloroplasts.

**46319 (EUR—9527-EN) Homogeneous and heterogeneous photocatalytic cleavage of water using sunlight.** Mackor, A.; Thewissen, D.H.M.W.; Eeuwhorst-Reintein, M.; Koster, T.P.M.; Kreuk, C.W. de; Timmer, K.; Tinnemans, A.H.A.; Zouwen-Assink, E.A. van der. (Commission of the European Communities, Luxembourg. Directorate-General for Information, Market and Innovation). 1984. 126p. Commission of the European Communities, Luxembourg. Office of Official Publications of the European Communities.

This study comprises a search for suitable photo(electro)chemical systems for practical water photoelectrolysis, which has only been realized so far with certainty by using semiconductor materials. These materials have been investigated as photoelectrodes to obtain physicochemical information, and as powders in aqueous suspension to obtain product information for the reaction: $+h\nu = 2H_2+O_2$. This reaction has been studied as a whole, and in separate water reduction and oxidation systems, using sacrificial components.

**46320 (EUR—9824-EN) Preparation, study and characterization of hydrogenated amorphous silicon for photovoltaic cells.** Coluzza, C.; Fortunato, G.; Scaglione, S.; Miriametro, A.; Evangelisti, F.; Frova, A.; Della Sala, D.; Mariucci, R.; Fiorini, P.; Giovannella, C. (Commission of the European Communities, Luxembourg. Directorate-General for Information, Market and Innovation). 1985. 106p. Commission of the European Communities, Luxembourg. Office of Official Publications of the European Communities.

Two techniques for the deposition of a-Si:H, and of its alloys with C and Ge, are described. Besides conventional RF glow-discharge, a novel deposition method is presented called dual ion-beam sputtering (DIBS). Its advantages and possible improvements are discussed. The basic physical properties - both structural and electronic - of the amorphous films produced by the two methods

are comparatively investigated by optical and transport characterization techniques. Visible and IR transmission, conductivity and spectral photoconductivity measurements show that the quality of our glow-discharge films - which is comparable to good material used in photovoltaic applications - is for the moment superior to DIBS material, due to residual metallic contamination of the latter. Aside from this, the DIBS technique has proved of great promise towards obtaining a-Si:H of high density, controlling hydrogen content and incorporation, and in situ production of solar cells. Preliminary photovoltaic devices - made with glow-discharge material and based on p-i-n and Schottky-barrier heterojunction structures - have been realised. The device aspects of the program have not been pursued too far, but the basic problems encountered in the fabrication of cells - material quality, doping, alloying with carbon for the window layer, contact formation, etc. - have been satisfactorily solved.

46321 **(EUR—9840-EN) Holographic thin film systems for multijunction solar cells.** Bloss, W.H.; Griesinger, M.; Laub, G.; Reinhardt, E.R. (Commission of the European Communities, Luxembourg. Directorate-General for Information, Market and Innovation). 1985. 57p. Commission of the European Communities, Luxembourg. Office of Official Publications of the European Communities.

Solar cell tandem systems consisting of two or more cells with different band gaps achieve a higher conversion efficiency than conventional single cells. One method of designing tandem systems is the spectral splitting of white sunlight by wavelength selective optical elements. For this purpose dichroic mirrors, dispersive Fresnel lenses or prisms are used so far. New elements which are well suited for spectrum splitting applications are volume phase holograms. These elements show a lot of advantages, like high efficiency, low optical losses, adjustable wavelength selectivity and low cost production. The holographic recording method allows spectral splitting and concentration with the same element. To demonstrate the effectivity of holographic optical elements in solar power generation, spectral distributions of the diffracted and undiffracted light are calculated for various types of holograms. In combination with ideal solar cells, the hologram data and the cell band gaps are optimized for maximum conversion efficiency. To calculate the conversion efficiency of a tandem system under real conditions, a model is used which takes into account the measured I-V characteristics and spectral quantum efficiencies. With this model a system is simulated consisting of a Si cell and a GaAlAs cell. The conversion efficiency of this system is 17.8% compared with the single cell efficiencies of 12.5% for Si and 16.7% for GaAlAs.

46322 **(INIS-mf—9742, pp 223-228) Use of autoradiography for the determination of algal production.** Desortova, B. (Ceskoslovenska Akademie Ved, Pruhonice. Ustav Krajinne Ekologie). 1983. NTIS (US Sales Only), PC A12/MF A01. File Number DE85781598. (CONF-8305206—).

From 13. international symposium on autoradiography; Tabor, Czechoslovakia (2 May 1983).

The autoradiographic technique is described applied to measuring photosynthesis of individual species of planktonic algae. The methodological approach consists in determinating $^{14}C$ assimilated by algae cells during photosynthesis from a $^{14}C$-labelled substrate. The autoradiographic technique described involves the placing of $^{14}C$-labelled algae cells on microscope slides and covering them with stripping film AR.10. After exposure and photographic development, the autoradiograms are evaluated according to the number of silver grains above the labelled cells. The number of silver grains is determined by direct counting under the microscope. Results obtained by using this method in the investigation of carbon fixation by individual cells of algae are reported. (author).

46323 **(NP—5770374) Solar cell arrays and residential buildings - architectural aspects of the integration of solar cell arrays in residential buildings.** Degheili-Abdallah, G. (Hannover Univ. (Germany, F.R.). Fachbereich Architektur). 5 Jul 1982. 199p. (In German). NTIS (US Sales Only), PC A08/MF A01. File Number DE85770374.

No doubt it is a task for architects to incorporate solar cell arrays in residential buildings. The publication first of all discusses the technical build-up of solar cells (photovoltaic effect, single-crystal and multi-crystal solar cells, state of development) and the build-up of solar cell arrays (roofing tiles containing solar cells, solar modules, hybrid collectors, fluorescence collectors) which can be integrated into residential buildings. As a basis for the discussion of buildings the constructional pre-requisites of roofs and outer walls are described. Problems are dealt with by the use of representative examples. With functional regards the relation of space wanted to space available is investigated. Furthermore the conditions of integration of solar cell arrays in residential buildings as well as the constructional conditions and possibilities of integration into roofs or outer walls are indicated. From the examples analysed the complexity of the integration of solar cell arrays in residential buildings is obvious.

46324 **(PB—85-201333/XAB) Development and characterisation of new materials to use as electrodes in photoelectrochemical solar cells designed to convert solar energy to chemical energy. Final report.** Goodenough, J.G.; Dare-Edwards, M.P.; Piffard, Y.; Choy, J.H.; Davies, K. (Commission of the European Communities, Luxembourg). [1985]. 148p. (EUR—9383-EN). NTIS, PC E07/MF E07.

An analysis was made of the materials required for a commercially viable photoelectrochemical cell for the direct conversion of sunlight into the chemical energy of gaseous hydrogen derived from water. The photoelectrochemical cell requires the design of a photoelectrode that provides both the electric power of a wet photovoltaic cell and the catalytic enhancement of the electrochemical reaction. Their experiment objective was to establish the engineering analysis, to test several material strategies, and to discover any unanticipated difficulties. At this point the authors swerved to the development of a suitable oxide catalyst for $O_2$ evolution and a method for its chemical attachment to a photoanode semiconductor surface.

46325 **(SERI/STR—211-2695) Studies of chemical vapor deposition of amorphous silicon and transparent electrodes for solar cells. Final report, 1 April 1983-30 September 1984.** Gordon, R.G.; Kurtz, S.; Proscia, J.; Gustin, K.; Chapple-Sokol, J.; Strickler, D. (Harvard Univ., Cambridge, MA (USA). Dept. of Chemistry). Aug 1985. Contract AC02-83CH10093. 46p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85016848.

This report presents results of research on atmospheric-pressure chemical vapor deposition (APCVD), a promising alternative deposition technique for preparing hydrogenated amorphous silicon for use in thin-film solar cells and for preparing transparent conductive electrode layers. The lack of ion bombardment, the observed high deposition rates, and the overall simplicity of the technology could mean a sizable cost reduction in the large-scale manufacturing of amorphous silicon solar cells. Solar cells with at least 8% efficiency should be possible with APCVD amorphous silicon. Titanium nitride films produced by APCVD were shown to provide low-resistance electrical contact to tin oxide and also to highly doped silicon (both p and n-type, crystalline and amorphous).

46326 **(SERI/STR—211-2731) Feasibility of using copper indium disulfide for high-efficiency, thin-film solar cells. Annual progress report, 1 November 1983-31 January 1985.** (Poly Solar, Inc., Garland, TX (USA)). Jul 1985. Contract AC02-83CH10093. 32p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85012173.

This annual technical progress report contains research results on the feasibility of using copper indium disulfide for high-efficiency, thin-film Solar cells, done by Poly Solar Inc. for the Solar Energy Research Institute. Technical approaches consisted of: (1) preparation of the $CuInS_2$ source material by direct synthesis; (2) deposition of $CuInS_2$ films on conducting and insulating substrates by the close-spacing chemical vapor transport technique; (3) deposition of $CuInS_2$ films by other chemical vapor deposition techniques; and (4) the formation and characterization of heterojunction solar cells. Deposition of p-type $CuInS_2$ films on graphite, alumina, and coated graphite substrates by the CSCVT technique using iodine and hydrogen iodide as the transport agent was carried out under several conditions. Compositional, structural, and electrical properties of the films were characterized. Heterojunction solar cells were

prepared from $CuInS_2$/graphite using various window materials. CdS/$CuInS_2$/graphite structures had an open-circuit voltage of 200-250 mV. The short-circuit current density and fill factor were low because of high series resistance. Preliminary work on the preparation of $CuInS_2$ films by the sulfurization of Cu-In has also been done. This process shows considerable promise.

**46327 (SERI/STR—211-2735) New ideas for photovoltaic conversion. Subcontract annual report.** Borrego, J.M.; Ghandhi, S.K. (Rensselaer Polytechnic Inst., Troy, NY (USA). Dept. of Electrical, Computer, and Systems Engineering). Jul 1985. Contract AC02-83CH10093. 72p. NTIS, PC A04/MF A01; GPO Dep. File Number DE85016852.

This report is a summary of the results obtained in the first year of a research program investigating the feasibility of using graded-band-gap solar cells under high illumination as an alternative to tandem cells. The graded-gap structure, studied both experimentally and theoretically, consisted of a p-Ga/sub 1-x/Al/sub x/As graded region from x = 0.33 to x = 0, followed by a GaAs p-n junction. The results indicate that the lightly doped p-region enhances the open-circuit voltage of the cell but deteriorates the fill factor. Problems associated with the growth of the layers are also outlined in this report.

**46328 (SERI/STR—211-2746) Investigation of electrochemical corrosion of semiconductors. Final subcontract report.** Frese, K.W. Jr.; Summers, D.P. (SRI International, Menlo Park, CA (USA)). Aug 1985. Contract AC02-83CH10093. 49p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85016853.

This final report describes the results for the sixth year of a research program concerning photoelectrochemical solar cells. Work for the first five years focused on the corrosion of semiconductors in electrolyte media. In the final phase, some different but related questions were considered: (1) adsorption and interface state properties of CdSe in alkaline sulfide media; and (2) electrodeposition of semiconductor thin films using the mass transport method of the rotating disk electrode. Impedance was measured on single-crystal n-CdSe electrodes in alkaline media. In the presence of NaOH, surface state densities were low. The flatband potential of n-CdSe was also measured as a function of sulfur-to-sulfide ratio. Cu, In, Se, Te, and Cd were electrodeposited with a rotating disk electrode. The stoichiometry of two elements in a binary semiconductor film was controlled by having appropriate concentrations in the electrolyte. Observed and calculated diffusion-controlled currents for CdTe deposition agreed within 1 to 2%. Results for $CuInSe_2$ were not as good, probably because of insufficient cathodic bias.

**46329 (SERI/STR—211-2750) Investigation of reactive magnetron sputter deposited ZnSe for solar cell application. Final subcontract report.** Stirn, R.J.; Nouhi, A. (Jet Propulsion Lab., Pasadena, CA (USA)). Aug 1985. Contract AC02-83CH10093. 62p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85016851.

As a higher bandgap semiconductor with reasonable lattice constant, ZnSe is an attractive alternative to CdS for heterojunction solar cells. Previous attempts to deposit doped n-type polycrystalline ZnSe films usually produced film resistivities from $10^5$ to $10^9$ ohm-cm unless GaAs substrates were used. This report presents results of one year's research into depositing high-conductivity ZnSe on glass substrates by reactive magnetron sputter deposition, using pure metal sputter targets of Zn and In, Ga, and Al dopants. Using substrate temperatures as low as 150°C and sputter parameters and $H_2Se$ injection rates that maximize the Zn-to-Se ratio in the films, ZnSe bulk resistivities were reduced to as low as 40 ohm-cm. The most effective dopant to date was In, co-sputtered with Zn to In atomic concentrations of 3%. AES measurements show an average 45/52 ratio of Zn to Se; a low Zn content for such conducting films. Extended studies of dopants' effects are warranted, as are heterojunction studies using thin-film $CuInSe_2$ and CdTe substrates.

**46330 (SERI/STR—211-2760) Diagnostics of glow discharges used to produce hydrogenated amorphous silicon films. Subcontract report, 15 April 1984-14 April 1985.** Gallagher, A.; Scott, J. (National Bureau of Standards, Boulder, CO (USA)). Jul 1985. Contract AC02-83CH10093. 38p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85016847.

Measurements of monosilane and disilane radicals were made at the surface of dc glow discharges (GD) in pure silane and silane-argon mixtures. These observations were interpreted as discharge kinetic models. It was inferred that the dominant radical, $SiH_3$, is produced in the gas and is primarily responsible for film growth. The heavier radicals observed in the gas appear to be a consequence of surface reactions, as is the disilane, a major product of the monosilane decomposition. A detailed model of the ion chemistry in the discharge was formulated to derive theoretical distributions of ions at the cathodes of low-pressure dc discharges. Chemical vapor deposition (CVD) rates of silane and disilane, measured previously in the laboratory, have now also been interpreted in detail to yield a self-consistent model for the CVD process. This model identifies and quantifies the role of $H_2$ as an inhibitor of silane GD and CVD deposition. Implications of these discoveries to deposition rates and film properties are discussed.

**46331 (SERI/STR—211-2777) Amorphous hydrogenated silicon germanium alloys suitable for photoelectronic applications. Annual subcontract report, 1 July 1984-30 Jun 1985.** Paul, W. (Harvard Univ., Cambridge, MA (USA). Dept. of Applied Science). Aug 1985. Contract AC02-83CH10093. 38p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85016849.

The principal objective of the first year of this research program has been to produce alloys of amorphous hydrogenated silicon germanium with a band gap near 1.5 eV that would have better photoelectronic properties than those of a-Si/sub 1-x/Ge/sub x/:H produced to date, that they might be used as components of a tandem solar cell. To this end, a glow-discharge apparatus was modified to permit deposition of alloys from fluorine-containing gases. Different series of alloys were to be produced by adjustment of gas mixtures, substrate temperature, gas pressure, gas flow rates and rf power. The improvements in photoconductivity suggest that further research is desirable to establish the properties of both electrons and holes in device structures made from fluorine-containing gases and to discover the differences in atomic structure and band structure responsible for the different photoelectronic responses.

**46332 (STEV—1984-1) IEA Forestry Energy annual report 1983.** (Statens Energiverk, Stockholm (Sweden)). 1984. 42p. (IEA-FE-AR—83). NTIS (US Sales Only), PC A03/MF A01. File Number DE85752530.

This document contains the report of the Executive Committee of the IEA Forestry Energy project. During 1983 six more projects were approved, making a total of twenty. Switzerland formally left the collaboration early in 1983. The total budget was 4.3 MSEK in 1983. There are considerable in-kind contributions in addition. The IEA Forestry Energy Agreement should continue when Annex I expires at the end of 1984. Progress in area B Growth and production was very impressive. Progress in area C, Harvesting was also good in 1983 on most of the projects. In comparison at least with progress in earlier years, progress in area D, Conversion in 1983 was good.

**46333 (STEV-SB—85-3) Determination of the biomass content of the stump-root system.** Nilsson, B. (Statens Energiverk, Stockholm (Sweden)). 1983. 38p. (In Swedish). NTIS (US Sales Only), PC A03/MF A01. File Number DE85752551.

The purpose of the project Stump functions is to develop statistical relationships between the biomass in the stump root system and easily measurable properties of standing trees. In the first period of the project, the definitions of the stump root system have been elucidated. Also the sampling design and the methods of handling sample trees have been worked out. It is necessary to find methods which can be used both in clear cutted areas and in dense stands. Therefore two different methods have been designed and

tested. - One manual method, where the tree is pulled down and the stump root system is broken loose from the ground. Cleaning is done manually and subsamples are cut with a chainsaw. - One mechanized method, where the stump root system is harvested and cleaned by a conventional stump extractor that is operating after final felling. The stump root system is harvested and cleaned by a conventional stump extractor that is operating after final felling. The stump root system is then smashed into chips, and subsamples are taken from this material for analysis. Tree and stand data has to be collected before final felling. These methods have been tested in some small-scale surveys. The results show that the methods can be used in a full-scale investigation.

46334 **(STU—83-5390) Microwave technique in the sawmill and wood industry.** Antti, L.; Moren, T.; Stridsman, P.E. (SEE CODE- 9860198 Styrelsen foer Teknisk Utveckling, Stockholm (Sweden)). Aug 1984. 133p. (In Swedish). Styrelsen foer Teknisk Utveckling, Stockholm (Sweden).

A survey of the applications of microwave techniques at drying procedures is presented. Some laboratory experiments are described. Current trials concerning drying by microwave technique in Sweden are reported. An assessment of future potential of large-scale applications has been made. 7 patent descriptions are appended in full.

46335 **Attainment of transparent boron-implanted layers for silicon solar cell applications.** Spitzer, M.B.; Keavney, C.J. (Spire Corporation, Patriots Park, Bedford, Massachusetts 01730). *Applied Physics Letters;* 47: No. 7, 731-732(1 Oct 1985).

The formation of boron-doped $p^+$ layers that are transparent to minority-carrier transport is reported. Ion implantation is used to limit the peak dopant concentration to $5 \times 10^{19}$ $cm^{-3}$ so as to avoid deleterious heavy doping effects. Solar cell open circuit voltage of 657 mV has been obtained in this way. The importance of surface passivation is indicated.

46336 **26% efficient magnesium-doped AlGaAs/GaAs solar concentrator cells.** Hamaker, H.C.; Ford, C.W.; Werthen, J.G.; Virshup, G.F.; Kaminar, N.R.; King, D.L.; Gee, J.M. (Varian Research Center, Palo Alto, California 94303). *Applied Physics Letters;* 47: No. 7, 762-764(1 Oct 1985).

AlGaAs/GaAs heteroface solar concentrator cells which exhibit 26% efficiency at 753 sun (AM1.5, 100 $mW/cm^2$) have been fabricated using metalorganic chemical vapor deposition. Magnesium was used as the dopant in the p-type emitter and selenium was used as the n-type dopant. The design parameters of the solar cell were determined with the aid of a computer program which realistically models the performance of such cells.

46337 **Method for making adhesive from biomass.** Russell, J.A.; Riemath, W.F. (to Dept. of Energy). US Patent 4,508,886. 2 Apr 1985. Filed date 30 Mar 1984. vp. PAT-APPL-595015.

A method is described for making adhesive from biomass. A liquefaction oil is prepared from lignin-bearing plant material and a phenolic fraction is extracted therefrom. The phenolic fraction is reacted with formaldehyde to yield a phenol-formaldehyde resin.

46338 **Narrow band gap amorphous silicon semiconductors.** Madan, A.; Mahan, A.H. (to Dept. of Energy). US Patent Application 6-690,218. 10 Jan 1985. 9p. Contract AC02-83CH10093. DE85017753 NTIS, PC A02/MF A01; GPO Dep. File Number DE85017753.

Disclosed is a narrow band gap amorphous silicon semiconductor comprising an alloy of amorphous silicon and a band gap narrowing element selected from the group consisting of Sn, Ge, and Pb, with an electron donor dopant selected from the group consisting of P, As, Sb, Bi and N. The process for producing the narrow band gap amorphous silicon semiconductor comprises the steps of forming an alloy comprising amorphous silicon and at least one of the aforesaid band gap narrowing elements in amount sufficient to narrow the band gap of the silicon semiconductor alloy below that of amorphous silicon, and also utilizing sufficient amounts of the aforesaid electron donor dopant to maintain the amorphous silicon alloy as an n-type semiconductor.

46339 **Process for producing peracids from aliphatic hydroxy carboxylic acids.** Chum, H.L.; Palasz, P.D.; Ratcliff, M.A. (to Dept. of Energy). US Patent Application 6-684,099. 20 Dec 1984. 28p. Contract AC02-83CH10093. DE85017738 NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85017738.

A process is described for producing peracids from lactic acid-containing solutions derived from biomass processing systems. It consists of adjusting the pH of the solution to about 8 to 9 and removing alkaline residue fractions therefrom to form a solution comprised substantially of lower aliphatic hydroxy acids. The solution is oxidized to produce volatile lower aliphatic aldehydes. The aldehydes are removed as they are generated and converted to peracids.

46340 **Improved method of preparing p-i-n junctions in amorphous silicon semiconductors.** Madan, A. (to Dept. of Energy). US Patent Application 6-679,842. 10 Dec 1984. 24p. Contract AC02-83CH10093. DE85017736 NTIS, PC A02/MF A01; GPO Dep. File Number DE85017736.

A method of preparing $p^+$-i-$n^+$ junctions for amorphous silicon semiconductors includes depositing amorphous silicon on a thin layer of trivalent material, such as aluminum, indium, or gallium at a temperature in the range of 200°C to 250°C. At this temperature, the layer of trivalent material diffuses into the amorphous silicon to form a graded $p^+$-i junction. A layer of n-type doped material is then deposited onto the intrinsic amorphous silicon layer in a conventional manner to finish forming the $p^+$-i-$n^+$ junction.

46341 **Process for selectively patterning epitaxial film growth on a semiconductor substrate.** Sheldon, P.; Hayes, R.E. (to Dept. of Energy). US Patent Application 6-678,202. 4 Dec 1984. 18p. Contract AC02-83CH10093. DE85017733 NTIS, PC A02/MF A01; GPO Dep. File Number DE85017733.

Disclosed is a process for selectively patterning epitaxial film growth on a semiconductor substrate. The process includes forming a masking member on the surface of the substrate, the masking member having at least two layers including a first layer disposed on the substrate and the second layer covering the first layer. A window is then opened in a selected portion of the second layer by removing that portion to expose the first layer thereunder. The first layer is then subjected to an etchant introduced through the window to dissolve the first layer a sufficient amount to expose the substrate surface directly beneath the window, the first layer being adapted to preferentially dissolve at a substantially greater rate than the second layer so as to create an overhanging ledge portion with the second layer by undercutting the edges thereof adjacent the window. The epitaxial film is then deposited on the exposed substrate surface directly beneath the window. Finally, an etchant is introduced through the window to dissolve the remainder of the first layer so as to lift-off the second layer and materials deposited thereon to fully expose the balance of the substrate surface.

46342 **Transmissive metallic contact for amorphous silicon solar cells.** Madan, A. (to Dept. of Energy). US Patent Application 6-676,047. 29 Nov 1984. 21p. Contract AC02-83CH10093. DE85017724 NTIS, PC A02/MF A01; GPO Dep. File Number DE85017724.

A transmissive metallic contact for amorphous silicon semiconductors includes a thin layer of metal, such as aluminum or other low work function metal, coated on the amorphous silicon with an antireflective layer coated on the metal. A transparent substrate, such as glass, is positioned on the light reflective layer. The metallic layer is preferably thin enough to transmit at least 50% of light incident thereon, yet thick enough to conduct electricity. The antireflection layer is preferably a transparent material that has a refractive index in the range of 1.8 to 2.2 and is approximately 550A to 600A thick.

46343 **Method for improving product yields in an anionic metalloporphyrin-based artificial photosynthesis system.** Shelnutt, J.A. (to Dept. of Energy). US Patent Application 6-676,046. 29 Nov 1984. 27p. Contract AC04-76DP00789. DE85017723 NTIS, PC A03/MF A01; GPO Dep. File Number DE85017723.

A method is disclosed improving product yields in an anionic metalloporphyrin-based artificial photosynthesis system for hydrogen generation. The method comprises forming an aqueous solution comprising an electron donor, methylviologen, and certain metalloporphyrins and metallochlorins, and irradiating said aqueous solution with light in the presence of a catalyst. In the photosynthesis process, solar energy is collected and stored in the form of a hydrogen. Ligands attached above and below the metalloporphyrin and metallochlorin plane are capable of sterically blocking photochemically inactive electrostatically bound $\pi$-$\pi$ complexes which can develop.

46344 **Chemically derivatized semiconductor photoelectrodes.** Wrighton, M.S. (Massachusetts Institute of Technology, Cambridge). *Journal of Chemical Education;* **60**: No. 4, 335-337(Apr 1983).

Modification of the surface of the semiconductor photoelectrodes have been shown to favorably alter the characteristics of photoelectrode durability, output photovoltage and output photocurrent. Significant results from modification of photoelectrode surfaces are reviewed in this article with 26 references being cited. The references are discussed under three general headings: suppression of photocorrosion of n-type semiconductors, improvement of rate of a desired anodic process, and improvement of rate of a desired cathodic process.

## 1406 Photovoltaic Power Systems

*REFER ALSO TO CITATION(S) 46312, 46825*

46345 **(NP—5902094) Guidebook on photovoltaic applications in Hawaii.** Richmond, R.C. (Hawaii State Dept. of Planning and Economic Development, Honolulu (USA) ). Oct 1984. 121p. NTIS, PC A06/MF A01. File Number DE85902094.

The purpose of this Guidebook is to provide the reader with a general understanding of PV power systems, their components, materials and processes; to introduce and explain PV terminology; to provide guidelines for evaluating the appropriateness of photovoltaics in specific applications; to offer a method of system sizing; and to project the future potential impact of PVs in Hawaii.

46346 **(SAND—85-1421C) PV concentrator array field performance measurement.** Maish, A.B. (Sandia National Labs., Albuquerque, NM (USA)). 1985. Contract AC04-76DP00789. 10p. (CONF-850783—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85016193.

From PV and isolation measurements workshop; Vail, CO, USA (1 Jul 1985).

This paper discusses the procedures used to measure concentrator module and array performance at Sandia National Laboratories. It describes the method used to characterize efficiency as a function of two independent variables, direct normal insolation (DNI) and the heat sink temperature. It then investigates the uncertainty in the measured efficiency due to the choice of independent variables. The paper concludes with a review of some of the factors that must be considered in a model which used the array efficiency equation to estimate annual system energy production.

46347 **(SAND—85-1764C) Photovoltaic array performance simulation models.** Menicucci, D.F. (Sandia National Labs., Albuquerque, NM (USA)). 1985. Contract AC04-76DP00789. 11p. (CONF-850783—2). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85016542.

From PV and isolation measurements workshop; Vail, CO, USA (1 Jul 1985).

The experience of the solar industry confirms that despite recent cost reductions the profitability of photovoltaic (PV) systems is often marginal and the configuration and sizing of a system is a critical problem for the design engineer. Construction and evaluation of experimental systems are expensive and seldom justifiable. A mathematical model or computer simulation program is a desirable alternative, provided reliable results can be obtained. Sandia National Laboratories, Albuquerque (SNLA), has been studying PV system modeling techniques in an effort to develop an effective tool to be used by engineers and architects in the design of cost-effective PV systems. This paper reviews two of the sources of error found in previous PV modeling programs, presents the remedies developed to correct these errors, and describes a new program that incorporates these improvements.

## 1407 Solar Thermal Power Systems

*REFER ALSO TO CITATION(S) 46756, 46956*

46348 **(DOE/DR/00789—T13) Small solar power systems plant in almeria system evaluation and comparison on a thermal basis.** Sandgren, J.; Andersson, M. (Studsvik Energiteknik AB, Nykoeping (Sweden); Theorells Ingenjoersbyra AB, Solna (Sweden)). 1985. Contract AC04-76DR00789. 179p. NTIS MF A01; 2; GPO Dep. File Number DE85017185.

The International Energy Agency's Small Solar Power Systems (IEA/SSPS) thermo-electric power plant in Almeria, Spain, consists of a distributed collector system (DCS) with three fields and a central receiver system (CRS). During the period of September 1983 to August 1984, the DCS-ACUREX field produced a daily average of 1.13 kWh/m$^2$ thermal energy from an average direct irradiation onto a field aperture of 4.48 kWh/m$^2$ and the DCS-MAN field 1.04 kWh/m$^2$ from 5.91 kWh/m$^2$ irradiated energy. In the Spring of 1984, an improved MAN field was put into operation and showed a considerable improvement compared to the original field. It produced 1.88 kWh/m$^2$ thermal energy from 6.96 kWh/m$^2$ daily mean beam irradiation. The CRS plant was proved to be capable of producing twice as much thermal energy per m$^2$ reflector area as the ACUREX field, and it is pointed out that for further development of high temperature applications it has greater opportunities than DCS fields. For solar thermo-electrical power generation, it is necessary to develop more compact thermo-electrical power conversion systems. Of existing engines, Stirling units show potential for adaptation to CRS plants.

46349 **(EUR—9838-EN) Salt gradient solar pond for solar heat collection and long term storage.** Unsworth, P.J.; Al-Saleh, N.; Phillips, V.; Butlin, B. (Commission of the European Communities, Luxembourg. Directorate-General for Information, Market and Innovation). 1985. 56p. Commission of the European Communities, Luxembourg. Office of Official Publications of the European Communities.

The solar pond project at the University of Sussex aims to study the design, construction, filling, and operation of salt gradient solar ponds, and to develop instrumentation for monitoring behaviour and performance. This paper describes the construction, filling, and operation of an outdoor pilot solar pond, and a simple means of maintaining salt density gradient, as well as work on pond transparency. To obtain high overall operating efficiency we have successfully experimented with extracting heat from both the non-convecting insulation layer and the convecting storage layer of the pond. This permits interception and extraction of heat flow in the non-convecting layer which would otherwise be lost at the surface. We have carried out laboratory and outdoor experiments to test whether this causes unwanted convective mixing in the non-convective zone, and have measured heat transfer coefficients achievable in that layer. Both steady-state and finite difference model calculations are presented to indicate the improvements in operating efficiency and temperature that are achievable with this method of heat extraction. Good applications and limitations are discussed.

46350 **(SERI/TP—255-2791) Optical properties of high-temperature materials for direct absorption receivers.** Jorgensen, G.J.; Schissel, P.; Burrows, R.W. (Solar Energy Research Inst., Golden, CO (USA)). Aug 1985. Contract AC02-83CH10093. 10p. (CONF-850887—24). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85012171.

From SPIE international technical symposium on optical and electro-optical engineers; San Diego, CA, USA (18 Aug 1985).

Recent solar central receiver designs emphasize direct absorption receiver (DAR) concepts primarily because of their ability to absorb high flux densities. An attractive design utilizes molten salt as the transport/storage fluid, which is pumped to the receiver and allowed to flow over a high-temperature absorber surface. As the salt runs down the absorber surface in a thin film, concentrated solar flux heats the salt to 900°C, either directly (blackened fluid) or by convective heat transfer with the irradiated absorber (clear fluid). The feasibility of such a design depends on the optical efficiency of the absorber/fluid combination. The optical properties of candidate absorber materials and transport fluids are therefore required at appropriate elevated temperatures. Because such salts can be extremely reactive at high temperatures, it is important to measure optical properties as a function of exposure history of the salt/absorber. Optical characterization of a clear molten carbonate salt ($Li_2CO_3$-$Na_2CO_3$-$K_2CO_3$ ternary eutectic) and a high-temperature metal alloy (Inconel 600) has been carried out at elevated temperatures using a recently developed integrating sphere solar spectrometer. Reflectance measurements of oxidized Inconel 600 alone and covered with several thicknesses of molten salt have been made. Measurements were also made of the reflectance of Inconel 600 samples that had been exposed to molten salt under high cyclic temperatures.

## 1408 Ocean Energy Systems

**46351 (PB—85-204295/XAB) Data report for the model test of a slope-mounted cold water pipe: final report and appendices.** Kompare, D.J.; Cotter, D.C.; Chakrabarti, S.K. (CBI Industries, Inc., Plainfield, IL (USA). Research Lab.). Apr 1985. 335p. NTIS, PC A15/MF A01.

A model test of a slope-mounted cold water pipe for a shelf-mounted Ocean Thermal Energy Conversion (OTEC) platform was performed in CBI Industries wave tank. The baseline model consisted of a cold water pipe mounted on a foundation sloped at 40° to the horizontal. This setup was chosen to simulate an at-sea test with a section of cold water pipe underway at Keahole Point, Hawaii. The baseline model was subjected to various environmental conditions involving waves and currents. The variations of the model consisted of different wave angles of attack, various elevations of the pipe off the bottom and two additional bottom slopes. Thus, the range of applicability of data covering the variations of wave angle, bottom gap, and bottom slope was substantially increased. In all cases, the model was completely submerged.

## 1409 Solar Thermal Utilization

*REFER ALSO TO CITATION(S) 46276, 46372, 46372, 46373, 46373, 46586, 46591, 46648, 46654*

**46352 (AD-A—154178/8/XAB) FPL (Forest Products Laboratory) design for lumber dry kiln using solar/wood energy in tropical latitudes. Technical report.** Tschernitz, J.L.; Simpson, W.T. (Forest Products Lab., Madison, WI (USA)). Apr 1985. 20p. (FSGTR-FPL—44). NTIS, PC A02/MF A01.

Developing countries with a timber resource that can be manufactured into finished products either for local use or export often lack the capital to build high-cost dry kilns. Many of these countries are in the tropics where solar radiation and ambient temperatures are high. The low-cost solar/wood energy lumber-dry kiln described was designed and tested by the Forest Products Laboratory (FPL) for such countries where solar dry kilns can be built and operated at low cost. The FPL design is for a 6,000-fbm capacity kiln having an insulated drying compartment, an external horizontal solar collector, and a furnace room containing a wood burner. Capacities larger or smaller than 6,000 fbm are also possible. This design allows collector and wood-burner sizing to match the energy demands of the dryer. This kiln design is the final, commercial-size version established after years of testing several 1,000-fbm capacity prototypes.

**46353 (DOE/CS/30261—T1) Johnson Controls Inc., Passive Branch Office Project. 1 year of performance results. Final technical report.** Schade, J.R. (Johnson Controls, Inc., Milwaukee, WI (USA)). Dec 1984. Contract FC02-80CS30261. 197p. NTIS, PC A09/MF A01; 1; GPO Dep. File Number DE85010196.

The overall performance of the prototype Passive Branch Office for Johnson Controls, Inc. is presented. Characteristics of the building include both direct and indirect evaporative cooling, exterior insulation, light shelves and clerestory, bottom blinds, computerized lighting, exposed duct work, and earth berms. The prototype design, though carefully screened by computer modeling, included some conservation measures which did not prove to be cost effective following construction and operation. In branches designed ater the Salt Lake prototype was built, the prototype has evolved into a simple, standardized branch model which contains straighforward passive and conservation measures. The building consumes about 50% of the energy used by Johnson Controls, Inc. branches build prior to the Salt Lake prototype, but was built at a cost similar to conventional offices of the same functional type (i.e., about $55 to 60/sq. ft.). The dollar savings amount to about $8000 annually in the 16,000 sq. ft. Salt Lake branch.

**46354 (DOE/R3/08090—T6) Gray's Ferry project: Phase II. Final report.** (Mid-Atlantic Solar Energy Association, Philadelphia, PA (USA)). [1985]. Contract FG43-81R308090. 6p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85009690.

A three-story rowhouse building was retrofitted to demonstrate solar heating and energy conservation in the Philadelphia, PA area. The retrofit included a solar greenhouse, a Trombe wall, and a solar hot water system. The Phase II Project funding was used for four specific endeavors: (1) tours; (2) brochures/literature; (3) a slide show presentation; and (4) signage showing the design of the active and passive solar systems. Three special workshops and more than fifteen tours of the building were given. A DOE funded study showed that a Trombe wall was the most cost-effective solar application for the 183,000 two-story brick row houses in the city. (BCS)

**46355 (DTH-LFK—F57-01) Solar-powered absorption-refrigeration systems. The use of solid absorbents in suspensions.** Clausen, N.E. (Danmarks Tekniske Hoejskole, Lyngby. Lab. for Koeleteknik). Jul 1984. 146p. (In Danish). NTIS (US Sales Only), PC A07/MF A01. File Number DE85752661.

Solar-Powered Refrigeration can help people in the developing countries to reduce a tremendous loss of foodstuffs because of lacking preservation facilities. Also for the preservation of medical supplies, especially vaccine, refrigeration is urgently needed. Another application of solar-powered refrigeration systems is comfort cooling. The refrigerant is ammonia and the solid absorbents considered were $CaCl_2$ and $SrCl_2$. Heptanol as the solvent is best suited for establishing a suspension of $CaCl_2$ and $SrCl_2$. Equilibrium measurements were performed on the system ammonia-heptanol as well as on the two suspensions of $CaCl_2$ and $SrCl_2$ in heptanol. Measurements of the reaction kinetics were performed at atmospheric pressure with the salt or the suspension kept in an erlenmeyer flask. The reaction rate is significantly increased during the addition of heptanol over that of the pure salt/ammonia reaction. Six different types of solar-powered refrigeration are reviewed, that is absorption systems, photovoltaic vapour-compression systems, Peltier systems, Rankine-engine driven vapour-compression systems, open cycle desiccant systems, and ejector cooling systems. Realization of a continous suspension system will give rise to some practical problems concerning the design of the pump and the heat-exchanger surfaces.

**46356 (DTH-LV-MEDD—158) Cheap solar collector/storage unit for domestic hot water supply.** Katic, I.; Furbo, S. (Danmarks Tekniske Hoejskole, Lyngby. Lab. for Varmeisolering). Dec 1984. 92p. (In Danish). NTIS (US Sales Only), PC A05/MF A01. File Number DE85752632.

Different principles of simple compact collector/storage units for domestic hot water supply are described and the costs, the

thermal performance and the durability of the units have been estimated. Different marketed simple solar heating systems for domestic hot water supply are included in the investigations. Based on the above mentioned investigations a thermosyphon solar water heater has been selected and built. The heater has been tested under realistic conditions on the test field of the Laboratory. Based on these tests the suitability of the unit was found. Different possibilities for improvement on the heater are described. The profitableness of the heat is a little better than the profitableness or ordinary solar heating systems for domestic hot water supply. A simple integrated collector/storage unit has been developed. The yearly performance of different integrated collector/storage units has been calculated by use of this model. The costs and profitableness of different units were found. The profitableness of such a simple unit is substantially better than the profitableness of normal solar heating systems for domestic hot water supply. Different possibilities for improvements of the units are mentioned. It is concluded, that work concerning development of such units should be encouraged, since it is possible to develop a most attractive integrated collector/storage unit. Until now, in Denmark very little work has been carried out in this field.

46357 **(DTH-LV-MEDD—165) BLAST - a computer program for calculation of passive solar heating.** Christensen, J.E. (Danmarks Tekniske Hoejskole, Lyngby. Lab. for Varmeisolering). Nov 1984. 216p. (In Danish). NTIS (US Sales Only), PC A10/MF A01. File Number DE85752634.

The interest in storing heat in buildings has steadily increased concurrently with the rising energy prices. This is tied to the fact that if surplus heat from the sun, people, electrical devices, etc. can be effectively utilized, a reduction of up to 20% of the heating expenses will be the purpose. The result of this project has been to try to use an advanced computer program for computation of the heating (and cooling) load and the indoor climate in buildings, with special reference to utilization of passive solar heat by means of heat storage in building components. Some forty computer programs have been analysed in a dialogue with a great number of experts, a study of literature and practical experience with some of the more important programs. The American computer program BLAST (the Building Loads Analysis and System Thermodynamics program) was chosen. This is due to the fact that the program is very suitable for simulating passive solar energy effects, with a high level of details, utilizing very detailed and exact algorithms. Furthermore, this program is fit for use, and the computation time is short. In the last part of the report, BLAST and the programs belonging to it are described. The purpose of this description is to give the reader an idea of the structure of the program and what facilities are included.

46358 **(EUR—8944-EN) Reduced reporting format for solar heating systems - for projects with low level monitoring. Passive space heating systems.** Ferraro, R.; Godoy, R. (Commission of the European Communities, Luxembourg. Directorate-General for Information, Market and Innovation). 1984. 16p. Commission of the European Communities, Luxembourg. Office of Official Publications of the European Communities.

This reporting format is a simplified version of one of the formats developed in 1982 by the Performance Monitoring Group (EUR no 7785, 7786 and 7787). The reduced format is intended for use in field trials with low-level monitoring, where fewer measuring points per house make the use of the full formats inappropriate. The new format, including a detailed User Guide, is available for distribution to organisations involved in solar heating applications.

46359 **(EUR—8945-EN) Reduced reporting format for solar heating systems - for projects with low level monitoring. Active space heating and water heating systems (combined).** Ferraro, R.; Godoy, R. (Commission of the European Communities, Luxembourg. Directorate-General for Information, Market and Innovation). 1984. 15p. Commission of the European Communities, Luxembourg. Office of Official Publications of the European Communities.

This Reporting Format is a simplified version of one of the formats developed in 1982 by the Performance Monitoring Group (EUR nos 7785, 7786 and 7787). The reduced format is intended for use in field trials with low-level monitoring, where fewer measuring points per house make the use of the full formats inappropriate. The new format, including a detailed User Guide, is available for distribution to organisations involved in solar heating applications.

46360 **(EUR—8948-EN) Solar heating.** Ferraro, R.; Godoy, R. (Commission of the European Communities, Luxembourg. Directorate-General for Information, Market and Innovation). 1984. 497p. Commission of the European Communities, Luxembourg. Office of Official Publications of the European Communities.

This document illustrates how solar heating systems can be designed to achieve maximum benefits for a given cost, and how to avoid problems encountered with earlier systems. The document presents seven exemplary solar heating systems. Each design was developed by a multi-disciplinary team covering the fields of solar heating system design, architecture, integration of solar components, manufacturing, assembly of solar heating systems and simulation modelling. The designs are described in detail, including their predicted performance and estimated costs. The document also illustrates the process by which the designs were improved to maximise energy savings per unit cost. Additionally, all the designs were reviewed on a common basis by experts in specific areas including architecture, engineering and performance simulations.

46361 **(EUR—9147) CEC solar energy modelling. Progress report of the Irish participant of the CEC modelling group, 1979/81.** Kelledy, E. (Commission of the European Communities, Luxembourg). 1984. 126p. Commission of the European Communities, Luxembourg.

This report describes the participation of the Irish participant in the CEC Solar Energy Modelling group effort in the period 1980-1981. The background to and objectives to the overall program are described. The development and programming of a solar system simulation model are discussed in some detail. The sensitivity of this model to changes in major system parameters is examined, and model-predicted system performance measures are compared to real data from Danish, Irish and Belgian test installations.

46362 **(EUR—9157) CEC modelling group for solar heating systems and domestic hot water II.** van Galen, E.; Havinga, J. (Commission of the European Communities, Luxembourg). 1984. 2p. Commission of the European Communities, Luxembourg.

This report gives the results of the tasks allocated to the Dutch participant in the European Modelling group. Contributions were made to all objectives of the work carried out under research contract no. ESA-M-113-NL (B) As follow: - a considerable extension and improvement of the initial versions of the European detailed model (EMGP) for solar systems was achieved. - The validation of the model with the aid of experimental data from the Solar Pilot Test Facilities appeared to be limited by the accuracy of the experimental data available. - The EMGP was used for system studies which showed that the modular structure indeed is extremely suited for the comparison of completely different solar systems for the same application. - The development of a European simplified method was achieved, this ESA show so far a better accuracy (smaller bias, less scattering) than existing simplified methods.

46363 **(EUR—9241-EN) Development of a solar energy installation for space heating and cooling based on hygroscopic materials.** Verdonschot, J.K.M. (Commission of the European Communities, Luxembourg. Directorate-General for Information, Market and Innovation). 1984. 53p. Commission of the European Communities, Luxembourg. Office of Official Publications of the European Communities.

This research work has been carried out for 50% under contract of the Commission of the European Communities and also for 50% under contract of BEOP-ECN (Bureau Energie Onderzoek Projecten, Energieonderzoek Centrum Nederland) in the scope of the Dutch National Solar Energy programme which is financed by the Department of Economic Affairs. The research work deals with the application possibilities for combined heating and cooling of an office building under Dutch climatic conditions. From previous studies (1), (2) we concluded that the application of a heat storage based on hygroscopic materials cannot be justified for residen-

tial heating systems. As hygroscopic materials are applied in desiccant cooling systems, the function of an adsorbent system can be enlarged by using it both in winter and in summertime. In the Netherlands such a heating and cooling demand only occurs in office buildings and some preliminary calculations (2) gave promising results. However, in this research we have been studying the total system design more in detail. With respect to the solar heating part of the system we conclude that only the direct use mode should be applied. Concerning the cooling part we have theoretically analyzed the system behaviour and experiments with a rotating desiccant bed have been carried out. The experimental results show a somewhat better performance then theoretically predicted. The total system performance for the Dutch climatic conditions is rather low which means that a solar system output of approx. = 550 MJ/m² (150 kWh/m²) can be expected. These numbers do not include the energy consumption of fans etc. which appears to be an important design factor.

46364 **(EUR—9464-EN) Final report of the European Passive Solar Modelling Sub-Group.** Dupagne, A.; Hauglustaine, J.M.; Cash, J.; Kupke, C.; Lebens, R.; Littler, J.; Lund, H.; Pernot, C.; Raoust, M.; Rubini, F. (Commission of the European Communities, Luxembourg. Directorate-General for Information, Market and Innovation). 1985. 164p. Commission of the European Communities, Luxembourg. Office of Official Publications of the European Communities.

The task of selecting reliable computer programs to simulate the performance of passive solar buildings has been assigned by the CEC to a specialized sub-group, the Modelling Sub-Group. This group has selected a detailed program for large computers, which has been commissioned and run by each participant. It has also given a reference for the analysis of a set of simple models, i.e. for mini/micro computers, pocket calculators and manual methods. These simulation techniques have been analyzed by answering an original questionnaire, making test runs of the models with building and climatic data, and comparing the results obtained with the large program. The best manual method has been included in the Passive Solar Handbook prepared by the Passive Solar Working Group. The MSG has also established a comparative table of all the selected simplified models, in order to make the designer able to do a first selection among them, in accordance with the hardware he has at his disposal, the budget he allocates to the purchase of the method and the passive solar devices he intends to model. The MSG has analyzed the chosen large program and given some recommendations for future improvements of it in the framework of the next CEC four-year research programme.

46365 **(EUR—9711-EN) Performance of a solar cooling system using different types of evacuated tubular collectors.** Hattem, D. van. (Commission of the European Communities, Luxembourg. Directorate-General for Information, Market and Innovation). 1985. 77p. Commission of the European Communities, Luxembourg. Office of Official Publications of the European Communities.

For several years experiments with solar air conditioning have been carried out in the Solar Laboratory of the Joint Research Centre of the Commission of the European Communities in Ispra. Performance data have been obtained for different systems using $LiBr/H_2O$ absorption chillers and selective flat plate collectors. This report gives a detailed description of the system which has been operated with Evacuated Tubular Collectors (ETC) during the summer of 1982 and 1983. The results obtained with this system during two summers are presented. The experiments showed that Evacuated Tubular Collectors can be used for solar cooling very well. The daily efficiencies for some collectors were excellent (around 50% for a typical day). Some diurability problems were identified. However these problems do not look unresolvable and should not inhibit the development of this kind of collectors.

46366 **(EUR—9720-EN) High performance passive solar heating system with heatpipe energy transfer and latent heat storage modules.** Dijk, H.A.L. van; Brink, G.J. van den; Hensen, J.L.M.; Raamt, A. van. (Commission of the European Communities, Luxembourg. Directorate-General for Information, Market and Innovation). 1985. 256p. Commission of the European Communities, Luxembourg. Office of Official Publications of the European Communities.

This project is aimed at developing a high performance passive solar heating system. This was to be achieved by the introduction of two special components: a) A thermal diode tube, which acts with small temperature difference already as a high performance thermal cnductor. b) The heat storage. This significant decrease in volume of 50 percents can be achieved by using water instead of concrete. Simultaneously with the cost analyses an extensive parameter study has been performed with an unsteady state model of the high performance passive solar system, under realistic climatic conditions and with realistic hourly heat demand, indoor air and wall temperatures for a few types of dwellings and occupants' behaviour, for typical Dutch circumstances. A further step was to develop a detailed constructive design for an extensive manufacturing cost analysis. For the constructive design and the cost calculations B.V. Koninklijke Maatschappij 'De Schelde' was involved in the project. The aim of this part of the research project was to develop a constructive design of a prototype high performance passive solar heating system which could be produced at reasonable costs. The design of the passive solar element is based on the following successive components: glass cover, small air gap, absorber plate, Z-shaped heat pipes through an insulation layer, a back plate between the diode tubes and the (latent) heat storage elements and a naturally ventilated air cavity with closable openings to separate the system from the room. One major part of the research was the optimization and testing of the innovative components, based on the preliminary conditions and the criteria developed at an earlier stage of the project.

46367 **(LA-UR—85-2844) Description and preliminary validation of a model for natural convection heat and air transport in passive solar buildings.** Jones, G.F.; Balcomb, J.D. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 7p. (CONF-851030—3). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85017563.

From SOLAR '85; Raleigh, NC, USA (15 Oct 1985).

We have proposed a transient, quasi-two-dimensional, numerical model for interzone heat flow and airflow in passive solar buildings. The paths for heat flow and airflow are through connecting apertures such as doorways, hallways, and stairways. The model includes the major features that influence interzone convection as determined from the results of our flow visualization tests and temperature and airflow measurements taken in more than a dozen passive solar buildings. The model includes laminar and turbulent quasi-steady boundary-layer equations at vertical heated or cooled walls which are coupled to a one-dimensional core model for each zone. The cores in each zone exchange air and energy through the aperture which is modelled by a Bernoulli equation. Preliminary results from the model are in general agreement with data obtained in full-scale buildings and laboratory experiments. The model predicts room-core temperature stratification of about 2°C/m (1.1° F/ft) and maximum aperture velocities of 0.08 m/s (15 ft/min.) for a room-to-room temperature difference of 1°F.

46368 **(LA-UR—85-2845) Natural convection airflow and heat transport in buildings: experimental results.** Balcomb, J.D.; Jones, G.F. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 6p. (CONF-851030—2). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85017562.

From SOLAR '85; Raleigh, NC, USA (15 Oct 1985).

Observations of natural convection airflow in passive solar buildings are described. Particular results are given for two buildings supplementing other data already published. A number of generalizations based on the monitoring of the 15 buildings are presented. It is concluded that energy can be reasonably well distributed throughout a building by natural convection provided suitable openings are present and that the direction of heat transport is either horizontally across or upward.

**46369 (LA-UR—85-2913) Influence of geometry on natural convection in buildings.** White, M.D.; Winn, C.B.; Jones, G.F.; Balcomb, J.D. (Colorado State Univ., Fort Collins (USA); Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 8p. (CONF-851030—4). NTIS, PC A02/MF A01; GPO Dep. File Number DE85017552.

From SOLAR '85; Raleigh, NC, USA (15 Oct 1985).

Strong free convection airflows occur within passive solar buildings resulting from elevated temperatures of surfaces irradiated by solar energy compared with the cooler surfaces not receiving radiation. The geometry of a building has a large influence on the directions and magnitudes of natural airflows, and thus heat transfer between zones. This investigation has utilized a variety of reduced-scale building configurations to study the effects of geometry on natural convection heat transfer. Similarity between the reduced-scale model and a full-scale passive solar building is achieved by having similar geometries and by replacing air with Freon-12 gas as the model's working fluid. Filling the model with Freon-12 gas results in similarity in Prandtl numbers and Rayleigh numbers based on temperature differences in the range from $10^9$ to $10^{11}$. Results from four geometries are described with an emphasis placed on the effects of heat loss on zone temperature stratification shifts.

**46370 (LA-UR—85-2914) Effect of plants on sunspace passive solar heating.** Best, E.D.; McFarland, R.D. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 7p. (CONF-851030—5). NTIS, PC A02/MF A01; GPO Dep. File Number DE85017551.

From SOLAR '85; Raleigh, NC, USA (15 Oct 1985).

The effect of plants on sunspace thermal performance is investigated, based on experiments done in Los Alamos using two test rooms with attached sunspaces, which were essentially identical except for the presence of plants in one. Performance is related to plant transpiration, evaporation from the soil, condensation on the glazing and the absorbtance of solar energy by the lightweight leaves. Performance effects have been quantified by measurements of auxiliary heat consumption in the test rooms and analyzed by means of energy balance calculations. A method for estimating the transpiration rate is presented.

**46371 (LBL—19271) Aerogel: a transparent insulator for solar applications.** Hunt, A.J.; Russo, R.E.; Tewari, P.H.; Lofftus, K.D. (Lawrence Berkeley Lab., CA (USA)). Jun 1985. Contract AC03-76SF00098. 8p. (CONF-850604—16). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85016551.

From INTERSOL '85 - Solar energy--the diverse solution; Montreal, Canada (23 Jun 1985).

Aerogel is a transparent, low density, insulating material suitable for a variety of solar applications. Significant energy savings can be realized by using aerogel for a window glazing material. Other possible applications include solar collector covers, transparent insulating jackets for direct gain passive solar devices, and situations that require both transparency and good insulation. Because silica aerogel has a low density (2 to 10% solid), it has a thermal conductivity as low as 0.014 W/m°K without evacuation, and if evacuated, lower than 0.006 W/m°K. It provides a clear view with only slight coloring due to its weak and nearly isotropic scattering of light. This paper describes significant progress made in the past year at our laboratory in the development of aerogel. We have improved the transparency, developed new preparation methods using less toxic materials, and initiated successful experiments in drying alcogels at near ambient temperature. Optical transmission, light scattering, and electron microscopy data show that $CO_2$ supercritical drying of alcogels produces aerogels similar in quality to those produced by high temperature supercritical drying. These advances make the commercial production of aerogel much more feasible.

## 1410 Solar Collectors And Concentrators

*REFER ALSO TO CITATION(S) 46275, 46336, 46350, 46356, 46586, 46912, 47163, 47209*

**46372 (EUR—8170-Ed.2) Irish solar pilot test facility. First operational phase.** Cowan, I.J. (Commission of the European Communities, Luxembourg). 1984. 166p. Commission of the European Communities, Luxembourg.

This report deals with the first operational phase of the Solar Pilot Test Facility under contract number ESA-T-006 EIR (B) between the Institute for Industrial Research and Standards and the Commission of the European Communities. This phase is a continuation of the original contract concerning the design and construction of the Solar Pilot Test Facility. A general description of the Solar Pilot Test Facility project and details of all facilities in the various participating countries is given. The programme of action during the first operational heating season 1980-81 is given, together with details from progress reports of the sequences applying to the two systems comprising the facility - the reference system (Solar System One) and the national system (Solar System Two). Included are details of the system configurations used, the operational problems and data exchange problems experienced, conclusions on system behaviour studies, and further work to be undertaken for model improvement. Other work undertaken, such as measurement of installation characteristics, and load analysis, of general interest to the Solar Pilot Test Facility Group, is also described.

**46373 (EUR—9155-EN) Solar Pilot Test Facility.** Ellehauge, K.; Olesen, O.B.; Andersen, N.B. (Commission of the European Communities, Luxembourg. Directorate-General for Information, Market and Innovation). 1984. 98p. Commission of the European Communities, Luxembourg. Office of Official Publications of the European Communities.

This report describes the work on the Danish Solar Pilot Test Facility in the period from October 1981 to June 1983. This work has been part of a 'concerted action' within the project A of the solar energy programme under the Commission of the European Communities (CEC). The Solar Pilot Test Facility Group consists of participants from the following 8 member-countries: Belgium, Denmark, France, Federal Republic of Germany, Ireland, Italy, the Netherlands and the United Kingdom. In the contractual period described in this report the work on the Danish SPTF has consisted in routined collection of measurements on different system configurations. In the SPTF's there are two measuring and control installations, the SS1 and the SS2. On the SS1 installation the system has been changed to a domestic hot water system and the effect of stratification and the effect of different heat exchangers has been investigated. On the SS2 installation there has been investigations on solar systems for combined space heating and domestic hot water. Two combined systems have been mounted and the latter is to be considered as a 2. generation 'ready to install' system. The investigations have been closely linked to the work in the European Modelling Group and calculations made of the Danish member of this group have formed the basis by the optimization of the system.

**46374 (EUR—9234-EN) Dutch solar pilot test facility - the state of affairs after two more years of normal operation.** Amerongen, G.A.H. van; Galen, E. van. (Commission of the European Communities, Luxembourg. Directorate-General for Information, Market and Innovation). 1984. 303p. Commission of the European Communities, Luxembourg. Office of Official Publications of the European Communities.

This report describes the results of the work carried out for the Commission of the European Communities by the Dutch participant of the Solar Pilot Test Facility Group under research contract no. ESA-T-007-80 ML during the period July 1981 - June 1983. This report is the third report in a row. The first report described the design, construction and first period of operation. The second report described solutions for starting problems, the development of the necessary procedures for the exchange of reliable data and the operation during the heating season 1980/1981. The

ultimate objective of this concerted action is fourfold: the production of accurate measuring data; the validation of a European model for solar energy installations with these data; the execution of system studies and the testing of newly developed solar components as part of solar energy systems. The measuring procedure is explained. The measures that were taken to guarantee accurate and reliable measuring data such as on-line check procedures and calibrations are discussed. The need of data about installation characteristics is recognized. Various methods to measure system parameters are explained and compared with each other. The solar systems tested including modified installations in both solar systems are discussed. Results from component tests as part of the total installation are given. The state of the art with respect to the experimental system studies and validation exercises is explained.

46375 **(EUR—9520-EN) Determination of the radiative properties of surfaces using reflectance techniques.** Dorman, G.J. (Commission of the European Communities, Luxembourg. Directorate-General for Information, Market and Innovation). 1984. 235p. Commission of the European Communities, Luxembourg. Office of Official Publications of the European Communities.

The solar absorptance and the thermal emittance of selective solar absorbers can be determined using different methods. Commonly these methods are classified as either direct or indirect. Direct methods (also called thermal methods) give the solar absorptance and the thermal emittance directly. Indirect or reflectance methods make use of the relation between the emittance, absorptance and the reflectance for opaque bodies. The reflectance of a surface is measured and from this value the emittance or absorptance is calculated. For a smooth surface the reflectance properties can be obtained quite accurately by simple devices. If the surface is rough, the reflected radiation scatters in all directions. The reflectance properties of these types of surfaces are less easy to determine and require the use of collecting devices such as an integrating sphere. For solar radiation these types of devices are commerically available. For thermal radiation there is a lack of such devices because the experimental difficulties are greater. These difficulties arise from the fact that thermal radiation has a much lower intensity than solar radiation. This report describes two measuring devices which have been constructed to determine the reflectance properties of rough surfaces in the thermal spectrum; an integrating sphere and an integrating ellipsoidal mirror. Both installations use a conventional infrared spectrophotometer. With this equipment the spectral reflectance of rough surfaces in the wavelength range (2.5-40 μm) can be determined. The use of these installations enables one to calculate the emittance properties of a sample and to perform optimisation studies on spectral-selective layers.

46376 **(NP—5752667) International Energy Agency program to develop and test solar heating and cooling systems. Task 3. Performance testing of solar collectors. Subtask b. Development of test procedures for reliability and durability. Failure modes of solar collectors.** (Danmarks Tekniske Hoejskole, Lyngby. Lab. for Varmeisolering). Aug 1981. vp. Danmarks Tekniske Hoejskole, Lyngby. Lab. for Varmeisolering.

This report contains a compilation and evaluation of 25 inspection reports on reliability and durability of solar collectors in existing solar energy systems. The reports are made by participants of the IEA Solar Heating and Cooling Programme, Task III, according to a format developed for this purpose. Different kinds of problems, changes and failures have been observed for all the inspected solar collectors. A presentation of the above with respect to collector part, problem area and influence from climate and surroundings is made.

46377 **(SERI/TP—253-2744) Analysis of simultaneous heat and mass transfer in soils below solar ponds.** Leboeuf, C.M. (Solar Energy Research Inst., Golden, CO (USA)). Jun 1985. Contract AC02-83CH10093. 7p. (CONF-850604—17). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85012163.

From INTERSOL '85 - Solar energy--the diverse solution; Montreal, Canada (23 Jun 1985).

This paper examines thermal losses from a solar pond to the underlying soil. A model that includes coupled heat and moisture transport in soils and was originally developed for agricultural analysis is extended to solar pond performance analysis. The model describes a physical system in which soil particles and void spaces are assumed to be randomly arranged ellipsoids in a continuous medium of water or air. The general problem reduces to two coupled partial differential equations, one for heat transfer, the other for moisture transport. Using property data for a specific soil, we use the model to determine under what conditions the soil will dry in response to the imposed thermal source of the solar pond and to predict the effect the steady-state soil conditions will have on pond performance. Results of this study also apply to other fields in which a heat source is directly coupled to the ground.

46378 **(SERI/TR—255-2590) Polymer synthesis and modification research during FY 1984.** Neidlinger, H.H.; Schissel, P. (Solar Energy Research Inst., Golden, CO (USA)). Jul 1985. Contract AC02-83CH10093. 73p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85012160.

This paper reports on our evaluation and modification of polymeric glazings to protect silver mirrors. The mirrors were made using Corning 7809 glass as a substrate onto which a thin silver film is deposited. The modified polymeric films are then cast from solution onto the silver. The mirrors were characterized by measuring the hemispherical reflectance and the specular reflectance at 660 nm and selected acceptance angles (15 mr or 7 mr). The mirrors were exposed to environmental degradation using accelerated weathering devices and outdoor exposure. Empirical evidence has demonstrated that polymethylmethacrylate is a stable polymer in a terrestrial environment, but the polymer does not provide adequate protection for the silver reflector. The crucial role in degradation played by ultraviolet (UV) light is shown by several experimental results. We have demonstrated that UV stabilizers added to the polymer improve the weatherability of mirrors. The relative effectiveness of different stabilizers will be discussed in terms of the weathering modes, retention of optical properties, and effectiveness of the additives. The process for silver deposition influences the reflectance of silver mirrors, and the optical properties, depend on subtle relationships between the metallization and the dielectric (polymeric) films that are in contact with the silver.

46379 **A stationary evacuated collector with integrated concentrator.** Snail, K.A.; O'Gallagher, J.J.; Winston, R. (Enrico Fermi Institute, University of Chicago, 5640 Ellis Ave., Chicago, IL). *Solar Energy;* **33**: No. 5, 441-449(1984).

A comprehensive set of experimental tests and detailed optical and thermal models are presented for a newly developed solar thermal collector. The new collector has an optical efficiency of 65 per cent and achieves thermal efficiencies of better than 50 per cent at fluid temperatures of 200°C without tracking the sun. The simultaneous features of high temperature operation and a fully stationary mount are made possible by combining vacuum insulation, spectrally selective coatings, and nonimaging concentration in a novel way. These 3 design elements are "integrated" together in a self containe unit by shaping the outer glass envelope of a conventional evacuated tube into the profile of a nonimaging CPC-type concentrator. This permits the use of a first surface mirror and eliminates the need for second cover glazing. The new collector has been given the name "Integrated Stationary Evacuated Concentrator", or ISEC collector. Not only is the peak thermal efficiency of the ISEC comparable to that of commercial tracking parabolic troughs, but projections of the average yearly energy delivery also show competitive performance with a net gain for temperatures below 200°C. In addition, the ISEC is less subject to exposure induced degradation and could be mass produced with assembly methods similar to those used with fluorescent lamps. Since no tracking or tilt adjustments are ever required and because its sensitive optical surfaces are protected from the environment, the ISEC collector provides a simple, easily maintained solar thermal collector for the range 100-300°C which is suitable for most climates and atmospheric conditions. Potential applications include space heating, air conditioning, and industrial process heat.

### 1420 Heat Storage

*REFER ALSO TO CITATION(S) 46292, 46660, 47302*

**46380 (DTH-LV-MEDD—168) Solar heating systems with thermal storage system integrated in the building structure.** Olsen, L. (Danmarks Tekniske Hoejskole, Lyngby. Lab. for Varmeisolering). Dec 1984. 69p. (In Danish). NTIS (US Sales Only), PC A04/MF A01. File Number DE85752658.

This report contains a study of the possibilities of using unconventional storage systems for solar-assisted space heating systems. To start with the project was carried out by a review and assessment of existing storage systems integrated in the building structure. A computer simulation model was developed for determination of the temperatures and heat fluxes for a system with a building model, a storage model and a solar collector model. A sensitivity study regarding the useful solar energy and the air temperatures has been completed. The performance of the system of solar collectors with different areas, storage volumes, storage types, thickness of storage insulation, control strategies and building thermal mass has been estimated. Simulations have been performed on an air based solar heating system and two types of storages were used, namely a rock bed system and a storage in hollow core slabs. Three different control strategies have been investigated: 1) supply of solar heated air without any other storage than the thermal mass in the building, 2) supply of solar heat to storage with passive heat discharge from the surface only, 3) a combination of active and passive discharge. On the basis of these results a set of design guidelines have been established and the report is concluded by the expected performance when the space heating system is combined with a domestic hot water system.

**46381 (PB—85-202224/XAB) Some limit results for an energy-storage model.** Hooghiemstra, G.; Scheffer, C.L. (Technische Hogeschool Delft (Netherlands). Onderafdeling der Wiskunde en Informatica). 1985. 13p. (REPT—85-01). NTIS, PC E03/MF E01.

In 1978, Haslett introduced a model to describe the temperature level in a tank used for the storage of solar energy. In this model, Y/sub n/ denotes the temperature level in the tank at time n. Subsequently, in a number of papers Daley and Haslett, Haslett, and Daley have, for various cases of the input (x /sub n/), calculated bounds for the mean of the equilibrium temperature. Hooghiemstra and Keane introduced a method to calculate the equilibrium distribution of y /sub n/ under the assumption that (x /sub n/) is an i.i.d. sequence of exponentially distributed random variables. In this paper the focus is on the behavior of the stationary distribution of y /sub n/ as beta approaches 1, when x /sub n/ is i.i.d. sequence.

## 15 GEOTHERMAL ENERGY

### 1501 Resource Status And Assessment

**46382 (SAND—85-1914C) Magma energy.** Hardee, H.C. (Sandia National Labs., Albuquerque, NM (USA)). 1985. Contract AC04-76DP00789. 4p. (CONF-851201—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85017372.

From 7. Miami international conference on alternative energy sources; Miami Beach, FL, USA (9 Dec 1985).

The paper briefly describes the potential magma resources in the US and worldwide, and possible ways of exploiting this resource. Two target sites for field experiments to characterize magma targets are identified: Long Valley Caldera and Coso Hot Springs. 11 refs. (ACR)

### 1503 Geothermal Exploration And Exploration Technology

**46383 (DOE/ET/27019—1) Geologic, geophysical, and geochemical aspects of site-specific studies of the geopressured-geothermal energy resource of southern Louisiana. Final report.** Pilger, R.H. Jr. (ed.). (Louisiana State Univ., Baton Rouge (USA). Dept. of Geology). 1985. Contract AC08-79ET27019. 241p. NTIS, PC A11/MF A01; 1; GPO Dep. File Number DE85016911.

The report consists of four sections dealing with progress in evaluating geologic, geochemical, and geophysical aspects of geopressured-geothermal energy resources in Louisiana. Separate abstracts have been prepared for the individual sections. (ACR)

**46384 (DOE/NV/10185—1) High-resolution, three-dimensional, seismic survey over the geopressured-geothermal reservoir at Parcperdue, Louisiana. Final report, January 1, 1981-July 31, 1985.** Kinsland, G.L. (University of Southwestern Louisiana, Lafayette (USA). Dept. of Geology). Jul 1985. Contract AC08-81NV10185. 290p. NTIS, PC A13/MF A01; 1; GPO Dep. File Number DE85016465.

A high resolution three-dimensional seismic survey was performed over the reservoir of the geopressured-geothermal production experiment at Parcperdue, Louisiana and high quality results have been obtained. The reservoir is now mapped with more control and assurance than was possible with the previously existing data. Three differences between the map of this project and those available before are significant in the interpretation of the depletion experiment: (1) the western bounding fault is further west leading to a larger reservoir volume; (2) a down to the north (relief) fault through the reservoir has been found; and (3) there are structural highs in which small petroleum accumulations may exist within the reservoir. An original goal of testing the before and after seismic experiment idea as a production monitor has not been realized. However, the quality of the data at the stages of processing presently available is high enough that, had the well not failed, it would have been prudent to have proceeded with the project toward the second experiment. 3 refs., 16 figs., 3 tabs.

### 1505 Economic And Financial Aspects

*REFER ALSO TO CITATION(S) 46385*

### 1506 Environmental Aspects And Waste Disposal

*REFER ALSO TO CITATION(S) 46067*

### 1509 Geothermal Engineering

**46385 (SAND—85-1866C) Drilling technology/GDO.** Kelsey, J.R. (Sandia National Labs., Albuquerque, NM (USA)). 1985. Contract AC04-76DP00789. 5p. (CONF-8509142—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85017231.

From Geothermal program review; Washington, DC, USA (11 Sep 1985).

The Geothermal Technology Division of the US Department of Energy is sponsoring two programs related to drilling technology. The first is aimed at development of technology that will lead to reduced costs of drilling, completion, and logging of geothermal wells. This program has the official title "Hard Rock Penetration Mechanics." The second program is intended to share with private industry the cost of development of technology that will result in solutions to the near term geothermal well problems. This program is referred to as the "Geothermal Drilling Organization". The Hard Rock Penetration Mechanics Program was funded at $2.65M in FY85 and the GDO was funded at $1.0M in FY85. This paper details the past year's activities and accomplishments and projects the plans for FY86 for these two programs.

# 16 TIDAL AND WAVE POWER

## 1608 Wave Energy Converters

46386 **(NP—5752641) Wave power converters 2.** Nielsen, K. (Danmarks Tekniske Hoejskole, Lyngby. Inst. for Skibs- og Havteknik). Jan 1982. 115p. (In Danish). Danmarks Tekniske Hoejskole, Lyngby. Inst. for Skibs- og Havteknik.

A method of converting ocean-wave-power into electricity is proposed and initially described. The principle is based on floating bodies, damped by single-working piston pumps placed on the sea-bed connected to a central submerged water turbine. An experimental investigation concerning the ability of floating bodies to absorb wave-power has been carried out. Experimentally determined efficiencies are presented for different body shapes and mass distributions in head- and beam seas. A comparison with efficiencies obtained by other elongated wave-power-converters shows that the peak values compare well, but the band-width of high efficiencies are much broader in the principle investigated. With regard to future development of the wave-power-converter a dimensioning procedure is proposed. The procedure takes into account the long term Weibull distribution of wave heights of a chosen ocean location and is based on general empirical relations derived from the model experiments combined with ISSC spectral description of the sea surface. The procedure is demonstrated taking the North Sea as an example. The wave climate of the North Sea is treated in Appendix D, where new measurements over a period of 2 years from an oilrig in the Danfield are compared with older light vessel observations presented in a previous report.

# 17 WIND ENERGY

## 1706 Wind Energy Engineering

46387 **(DOE/NASA—4105-1) Experimental investigation of a variable speed constant frequency electric generating system from a utility perspective.** Herrera, J.I.; Reddoch, T.W.; Lawler, J.S. (Electrotek Concepts, Inc., Knoxville, TN (USA)). May 1985. Contract AI01-76ET20320. 50p. (NASA-CR—174950). NTIS, PC A03/MF A01; GPO Dep. File Number DE85017351.

As efforts are accelerated to improve the overall capability and performance of wind-electric systems, increased attention to variable speed configurations has developed. A number of potentially viable configurations have emerged. Various attributes of variable speed systems need to be carefully tested to evaluate their performance from the utility point of view. With this purpose, the NASA, experimental variable speed constant frequency (VSCF) system based on a design by F.R. Schleif has been tested. In order to determine the usefulness of these systems in utility applications, tests are required to resolve issues fundamental to electric utility systems. Legitimate questions exist regarding how variable speed generators will influence the performance of electric utility systems; therefore, tests from a utility perspective have been performed on the VSCF system and an induction generator at an operating power level of 30 kW on a system rated at 200 kVA and 0.8 power factor.

46388 **(DOE/SF/01974—T1) [Wind electric systems]. Final report.** Sencenbaugh, J.R. (Sencenbaugh Wind Electric, Mountain View, CA (USA)). 1 Jun 1981. Contract FG03-78SF01974. 196p. NTIS MF A01; 2; GPO Dep. File Number DE85013409.

This report details the results of a demonstration project, the design and testing of a low power, high reliability wind electric system for remote, stand-alone locations. The study consisted of two basic areas. An engineering redesign of a sucessful preproduction prototype to determine best material usage in castings and manufacturing time, in addition to evaluating performance vs cost tradeoffs in design. The second stage of the program covered actual field testing of the redesigned machine in remote areas. After field testing, the machine was to undertake a final redesign to correct any weak areas found during the field evaluation period. Three machines of this design were tested throughout various regions of the United States. These units were located in Nederland, Colorado, Whidbey Island, Washington and Fort Cronkite, San Francisco, CA. The results obtained from prolonged testing were both varied and valuable. A detailed structural analysis was done during the preliminary redesign and final design stages of this program. This report is organized in chronological order.

46389 **(EEV—81-04) Measurements on the Nibe wind turbines January 1980-March 1981.** (Danske Elvaerkers Forenings Udredningsafdeling (DEFU), Lyngby). May 1981. 118p. NTIS (US Sales Only), PC A06/MF A01. File Number DE85752629.

This report gives a detailed description of the measurement activities in Nibe from the time when operation of the turbines began (January 1980) until the official end of phase 1 and 2 (March 1981). Some measurements made during the preparation of the report are included in the results, for instance the power curve for turbine B. The report is a preliminary report, which means that much still remains to be done, and some conclusions may be modified as supplementary data become available. As examples could be mentioned the stall induced vibrations on turbine A and the fatigue problems on turbine B. It would also be relevant to determine the power losses in the transmission system with greater accuracy, thereby , procuring more precise power curves. The difference between the two turbines with respect to control modes, i.e. stall regulation versus pitch control, must also be investigated.

46390 **(NP—5770358) Appraisal of the current situation and evaluation of the experience gained with wind power plants in the FRG. 2. Interim report: Wind energy in the USA, 1983.** (Deutsche Gesellschaft fuer Windenergie e.V., Eckernfoerde (Germany, F.R.)). Sep 1983. 26p. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number DE85770358.

A general survey of the present situation of wind power utilization in the USA. The report particularly refers to the existing types of wind power conversion systems their application problems, the types of government and they research receive, and the success of wind power plants on the market, partly comparing them to the conditions in the Federal Republic of Germany. The beneficial tax incentives in connection with the utilization of wind energy, wind farms, and the legal bases and restrictions with regard to the propagation of wind power plants are also shown.

# 20 ELECTRIC POWER ENGINEERING

46391 **(DOE/ET/29032—T1) Dynamic stability of electric power systems. Final report, September 1978-January 1982.** Sherkat, V.R. (Systems Control, Inc., Palo Alto, CA (USA)). Jun 1985. Contract AC01-78ET29032. 178p. NTIS, PC A09/MF A01; 1; GPO Dep. File Number DE85016426.

Multi-input and multi-output frequency domain methods are developed and implemented for the study of power system dynamic stability and robustness of stability due to system parameter perturbations. The linearized dynamic model for an interconnected power system is cast into the form of a multivariable feedback system. A number of different multiple-input, multiple-output (MIMO) feedback configurations can be realized. Each of these model the linearized dynamics of the interconnected power system and retain the sparsity of the system. The stability of the feedback system is determined through the application of the Nyquist encirclement criterion to the determinant of the return-difference matrix. Examples for a study system are presented which further illustrate the method. The practical aspects of the proposed approach for application to realistically-sized power systems are discussed. For the study of robustness of dynamic stability, perturbations in the operating point resulting from variations in power supply and demand quantities and eventually leading to the perturbations of the linearized feedback system are of primary interest. Three approaches are considered: (1) an approach based on matrix-norm robustness criteria, (2) an optimization-based approach using the return-difference matrix, and (3) an approach using stability and robustness results for the component connection model. The first and second approaches are illustrated using examples of single machine and an infinite-bus system.

46392 **(EPRI-EL—4002) On-line incipient fault detector. Final report.** Kurz, R.A. (Westinghouse Electric Corp., Sharon, PA (USA)). Sep 1985. 93p. Research Reports Center, Box 50490, Palo Alto, CA, 94303. File Number TI85920858.

A continuous gas monitor operating on site could alert utilities at an early stage to incipient faults in transformers. Two prototype devices, which collect gases from the transformer oil through a perfluorosilicone membrane for daily automatic analysis, proved technically successful in field testing.

## 2001 Power Plants And Power Generation

*REFER ALSO TO CITATION(S) 46397, 46981, 47435*

46393 **(EPRI-AP—4216) Availability analysis handbook for coal gasification and combustion turbine-based power systems. Final report.** Himpler, H.P.; Young, R.C. (Arinc Research Corp., Annapolis, MD (USA)). Aug 1985. 256p. Research Reports Center, Box 50490, Palo Alto, CA, 94303. File Number TI85920864.

This handbook addresses the analysis of the reliability, availability, and maintainability (RAM) of advanced-technology coal gasification power generation plants, subsytems, and components. It includes methods, procedures, and data needed to perform complete RAM analyses of advanced-technology coal gasification plants. 9 refs., 41 figs., 44 tabs.

46394 **Fluidized bed combustor-heater equipped gas fired CCGT.** Fejer, A.A. (Institute of Gas Technology, Chicago, IL). *American Society of Mechanical Engineers, [Paper]*; 1-4(1984).

The combustion of natural gas in an atmospheric fluidized bed combined with heat transfer from the bed to the working fluid is shown to be an attractive means for supplying heat to closed cycle gas turbines. It is demonstrated how this concept can yield high thermal efficiencies without the use of high temperature resistant materials and yield low levels of pollutant emissions. The features of the combustor-heater are established for a 9000 kW closed cycle gas turbine generator and comparisons are made with a conventional open cycle machine.

## 2002 Environmental Control Technology

*REFER ALSO TO CITATION(S) 45970, 45978, 45979, 45980, 45981, 45985, 45987, 45988, 45991, 45994, 45995, 45996, 45998, 45999, 46006, 46014, 46018, 46019, 46021, 46022, 47208, 47235, 47244*

46395 **(DOE/ET/17091—1864) Electrocyclone Development Program. Final report.** Giles, W.B.; Bekofske, K.L.; Kallio, G.A. (General Electric Co., Schenectady, NY (USA). Advanced Energy Programs Dept.). Dec 1983. Contract AC21-80ET17091. 199p. NTIS, PC A09/MF A01; 1; GPO Dep. File Number DE85013605.

The electrocyclone is an adaptation of a conventional cyclone in which a high-voltage electrode, inside the cyclone, charges the dust particles and provides an electric field which augments the inertial forces driving particles to the cyclone wall. Since the electric field forces do not decrease as the cyclone is made larger, a large (6 to 10 ft) electrocyclone can achieve collection efficiencies comparable to a one or two-ft diameter conventional cyclone. A major result of the Electrocyclone Development Program has been the development of a new high-flow cyclone design. A series of experiments were conducted in which the cyclone dimensions were systematically varied to assess their influence on collection efficiency. As a result, a high-flow cyclone was developed in which the exhaust tube diameter and its penetration into the cyclone were increased. This, plus the addition of a large high-flow inlet scroll, resulted in a cyclone which has four times the flow capacity of conventional high efficiency designs for a given diameter. The efficiency is comparable to conventional designs and the increase in pressure loss was a modest 38%. The ability to handle increased throughput decreases system costs. The electrocyclone was, therefore, reconfigured to include the new high-flow features. At the conclusion of the Electrocyclone Development Program, technical uncertainties regarding the performance of both conventional and electrostatically enhanced cyclones were substantially resolved. Early hopes that New Source Performance Standard for particulate emissions could be met with electrocyclones were not supported by the extensive experimental results. The consequent need for additional stack gas cleanup after the gas turbine is a major disadvantage in cost and complexity relative to other hot gas cleanup devices under development.

46396 **(DOE/FC/10271—1875) Attenuation properties of soils from the waste disposal site of a Texas lignite-fired power plant.** McFarland, A.R.; Ortiz, C.A.; Slowey, J.F.; Rivera, G.M. (Texas A and M Univ., College Station (USA). Dept. of Civil Engineering). Nov 1984. Contract AC18-81FC10271. 62p. NTIS, PC A04/MF A01; GPO Dep. File Number DE85014363.

Samples of soil and plant solid wastes were collected at the site of a lignite-fired electrical generation facility near San Antonio, Texas. Ranging studies provided information on the chemical constituents of both the matrices and leachates. For this particular site the overburden soils are slightly basic (pH ≃7.5). A large (≃200 kg) composite overburden sample was collected. The chemical composition was characterized by both neutron activation and analysis of leachates. Columnar studies were performed to determine the attenuation characteristics of the soil. Both arsenic and selenium readily penetrate the soil samples. Selenium, which was introduced to the column at an influent concentration of 673 μg/L was initially observed in the effluent at a concentration of <1 μg/L. After the passage of 10 L of artificial leachate solution per kg of soil, the effluent concentration was ~200 μg/L. The effluent concentration rose to ≃500 μg/L after exposure of the sample to ≃ 30 L/kg.

46397 **(DOE/MC/16471—1887) Performance of an electrostatic precipitator at simulated pressurized fluidized-bed combustion (PFBC) conditions.** Rugg, D.E.; Rinard, G.A.; Durham, M.D.; Armstrong, J.A.; Butz, J.R. (Denver Research Inst., CO (USA)). Jul 1985. Contract AC21-81MC16471. 120p. NTIS, PC A06/MF A01; GPO Dep. File Number DE85013680.

Results are given in this report for testing at Denver Research Institute's High Temperature-High Pressure Electrostatic Precipitator (HTHP-ESP) Facility, for the period 2 September 1981 to 31 December 1984. This work is part of the DOE/Fossil Energy's Gas Stream Cleanup Program. The objective of this work was to determine technical feasibility of ESPs as final particulate cleanup devices for Pressurized Fluidized Bed Combined Cycle Power Plants. Test results are given for electrical conditions for three corona electrodes operating under clean and dirty conditions for temperatures from 705° to 955°C (1300° to 1750°F) and pressures 510 and 640 kPa (5.1 and 6.4 atm). PFBC conditions were simulated by reentrainment of fly ash from the Curtiss-Wright small gas turbine test rig into the flue gas stream from a methyl alcohol burner. Results of mass efficiency measurements are presented for temperatures of 743° to 915°C (1370° to 1680°F) at a pressure of 640 kPa (6.4 atm). Both of the results are for negative corona. However, some data for positive corona are presented. Tests were performed to supplement the data from the foreshortened sub-pilot scale ESP tests performed by Cottrell Environmental Sciences at the Curtiss-Wright test facility. Tests were first performed to verify that the DRI facility adequately simulated conditions at Curtiss-Wright. These results are presented together with results from tests whih extended the operating temperature and pressure beyond that possible at Curtiss-Wright. Results for initial parametric testing are presented. The parametric test program was not completed due to mechanical problems in the precipitator. A test plan is presented for the completion of this work which is expected to be completed within the next year and reported on later. 7 refs., 45 figs., 15 tabs.

46398 **(DOE/MC/20107—T3) Development of acoustic agglomerator. Test plan for high temperature high pressure acoustic agglomerator.** (Pennsylvania State Univ., University Park (USA); Aerojet Energy Conversion Co., Sacramento, CA (USA)). 12 Aug 1985. Contract AC21-84MC20107. 16p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85017221.

The design specifications for the HTHP AA Facility are listed in Table 1. The facility is an open-loop, air flow system with subsystems and components to provide the high temperature, high pressure, residence time, dust loading and acoustic irradiation to simulate the aerosol and Hot Gas Cleanup (HGCU) AA system of a Pressurized Fluid Bed Combustor (PFBC), Combined Cycle Power Plant. Data sampling, instrumentation, and automatic controls and data analysis systems are also provided. This test plan describes the testing to be done on the high temperature, high pressure acoustic agglomerator (HTHP AA) at Penn State University's High Intensity Acoustic Laboratory on Department of Energy Contract No. AC21-84 MC20107.

46399 **(EPRI-EA—4215) Leaching studies on utility solid wastes: feasibility experiments. Final report.** Kuryk, B.A.; Bodek, I.; Santhanam, C.J. (Little (Arthur D.), Inc., Cambridge, MA (USA)). Aug 1985. 303p. Research Reports Center, Box 50490, Palo Alto, CA, 94303. File Number TI85920860.

This report describes the results obtained in the laboratory feasibility experiments. This research showed that it is feasible to design and conduct laboratory experiments to define the rapid release of elements present on the surface of waste particles or in the moisture retained by the waste material. However, the limited amount of experimentation did not allow clear identification of any long-term leaching processes that could be used to quantitatively describe the release rates for components of coal flyash, oil ash and dry sorbent FGD waste. The experimental results were suggestive of a number of possible leaching behaviors, but it was not possible to assign a particular aqueous species or group of species to a specific leaching process, nor was it possible to develop a ranking of the relative importance of the various leaching processes. The possible leaching processes that were expected to have occurred in the feasibility experiments include: rapid initial leaching of particle surfaces and interstitial liquid material, slower kinetically-controlled matrix dissolution, solubility controlled releases, and, possibly, absorption. The results of the feasibility experiments showed that: the release rates of several inorganic species from coal flyash and dry sorbent FGD wastes differ from those observed for oil flyash wastes; and many elements that were expected to be released from the solid wastes were found to be below detection analytical levels in the extracts. 4 figs., 43 tabs.

## 2003 Power Transmission And Distribution

46400 **(OA-Trans—3219) Protection products for the conductors of high voltage overhead lines.** (Electricite de France, 75 - Paris). [1985]. Translation of EDF Technical Specification HN 67-S-01, 2 December 1981, 12 pages. 15p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85902058.

This specification applies to greases or petrolatums for corrosion protection of conductors of high-voltage overhead lines. It specifies the requirements for identification documents, evaluation tests, and quality control tests. (DLC)

# 21 NUCLEAR POWER PLANTS

*REFER ALSO TO CITATION(S) 47856*

46401 **(KFK—3822) Experimental investigations on the fluid flow through an asymmetric rod bundle (P/D = 1.148, W/D = 1.222).** Rehme, K. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Neutronenphysik und Reaktortechnik; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Schneller Brueter). Mar 1985. 75p. (In German). B. File Number DE85752242.

Measurements of the distributions of the mean velocity, the wall shear stresses and the turbulence were performed in a wall subchannel of a rod bundle of four parallel rods arranged asymmetrically in a rectangular channel (P/D = 1.148, W/D = 1.222). The Reynolds number of this investigation was $Re = 1.61 \times 10^5$. The experimental results show that the momentum transport is highly especially in the gap between the rods. Influences of secondary flows cannot be detected in the distribution of the time-mean velocity. The comparison between experimental wall shear stress distributions and those calculated by the VELASCO-code shows discrepancies especially in the gap between the rods caused by the high momentum transport between the subchannels of different geometry.

## 2101 Power Reactors, Non-breeding, Light-water Moderated, Boiling Water Cooled

*REFER ALSO TO CITATION(S) 46438, 46440, 46482, 46484, 46486, 46487, 46504, 46517, 46526, 46527, 46529, 46531, 46535, 46538, 46545, 46551, 46552, 46562, 46564, 46567, 46968*

46402 **(DOE/NBM—5016660) Corrosion studies of nuclear piping in BWR environments. Quarterly report for quarter ending June 30, 1977.** Shack, W.J.; Park, J.Y.; Ellingson, W.A. (Argonne National Lab., IL (USA)). Jun 1977. Contract W-31-109-ENG-38. 30p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85016660.

Throughwall residual-stress measurements have been completed on two specimens cut from 4-in. mockup weldments W27A and W27B. The residual-stress distributions obtained are similar to those expected from thin-shell theory, i.e., the self-equilibrating stresses remaining after the net force and moment acting on the section have been relieved are fairly small. On the basis of these preliminary results, the simple linear distribution of stress seems to be a reasonable approximation to the throughwall distribution of stress in the most heavily sensitized portion of the heat-affected zone. The degree of sensitization was measured in the heat-affected zones of 4-in. pipe weldments W27B, RBBJ-13, and 10-25, using the potentiodynamic polarization technique. Sensitization measurements were also made on furnace-sensitized Type 304 stainless steel using a portable potentiodynamic polarization test probe. Three mock-up wedge-opening loading specimens for the crack-propagation studies were prepared, and fatigue precracking of the specimens was completed.

46403 **(EPRI-NP—3768-CCM-Vol.1) BODYFIT-2PE-HEM: LWR core thermal-hydraulic code using boundary-fitted coordinates and two-phase homogeneous equilibrium model. Volume 1. Theory and formulation.** Chen, B.C.J.; Chien, T.H.; Sha, W.T. (Argonne National Lab., IL (USA)). Aug 1985. Contract W-31-109-ENG-38. 137p. NTIS, PC A07/MF A01; 1 - Research Reports Center, Box 50490, Palo Alto, CA 94303; GPO Dep. File Number DE85017434.

BODYFIT-2PE-HEM is a steady-state/transient, three-dimensional computer program for thermal-hydraulic analyses of single- and two-phase flow problems in light-water-reactor fuel assemblies. The primary objective of developing the code is to apply it for benchmark and design calculations. It uses the homogeneous equilibrium model with algebraic slip to describe two-phase flow dynamics. Subcooled boiling and flow-regime transition are accounted for through empirical correlations. The unique features and characteristics of the BODYFIT-2PE-HEM code are: (a) it uses the technique of the boundary-fitted coordinate system where all the physical boundaries are transformed to coincide with constant coordinate lines in the transformed space; (b) the code uses the parabolic approximation to save computer running time and storage; and (c) additional grid lines between fuel rods provides higher resolution of both the velocity and temperature fields, as well as more accurate treatment of diffusion terms in both the momentum and energy equations in the present code than those in the subchannel codes. These features also provide a better mechanism for modeling turbulence, due to its more accurate representation of velocity gradients. 37 refs., 19 figs.

46404 **(EPRI-NP—4223) Intergranular attack of alloy 600: laboratory investigations.** Pinard-Legry, G.; Plante, G. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Section d'Etude de la Corrosion Aqueuse; Framatome, 92 - Paris La Defense (France)). Aug 1985. 71p. Research Reports Center, Box 50490, Palo Alto, CA, 94303. File Number TI85920866.

In order to define some of the parameters of the IGA phenomenon, chemical and electrochemical corrosion tests were performed on alloy 600 C-ring samples in caustic media at high temperature. Metallographic examinations showed that temperature and the composition of the solution has a marked effect on the occurrence of IGA. In 36% caustic solution, silicate did not inhibit corrosion as was the case in more dilute solution. The presence of magnetite had an adverse effect probably because it changed the local chemistry. The electrochemical potential effect was not significant on IGA morphology in the range E/sub corr/ +- 20 mV. Tensile stress increased the rate of IGA but was not necessary in order to produce IGA in an already aggressive environment. The presence of oxides did not change the alloy 600 corrosion potential significantly, except for $Cr_2O_3$. Borate ions had an inhibiting effect on IGA in 10 % caustic. The addition of boric acid to 10 % caustic produced changes in pH at high temperatures which were measured as part of this report. 6 refs., 30 figs., 12 tabs.

46405 **(EPRI-NP—4225M) Fuel channel lifetime: expansion of statistical predictive models. Final report.** Gorman, J.A.; Shimansky, R.A.; Turner, A.P.L. (Dominion Engineering, Inc., McLean, VA (USA)). Sep 1985. 33p. Research Reports Center, Box 50490, Palo Alto, CA, 94303. File Number TI85920867.

Predictive models developed earlier for use in estimating BWR fuel channel deformation due to irradiation were expanded and refined. Statistical accuracy of the models was improved by inclusion of more data, and the exposure range of the models was extended to reflect the new data. Deformation models were developed for a fourth fuel channel type. The additional data for channels irradiated in BWR3 and ASEA-ATOM reactors confirm earlier observations that channels manufactured using a high temperature thermal sizing process deform significantly less during irradiation than channels made without such a high temperature process. Numerous channels irradiated for a second fuel assembly lifetime in one reactor exhibited large bows diagonally away from the control rod at the end of a second fuel assembly lifetime. The cause of these bows has not been determined. However, the characteristics of the bowing indicate it could be due to channel - fuel assembly mechanical interaction. Calculated control rod interference values, based on measured channel deformation, were analyzed for a specific core. The calculated interference values exceed the current allowable limits but have not caused operational problems. This confirms that these limits can be relaxed without an impact on reactor operation. 7 refs., 2 figs., 1 tab.

46406 **(INIS-mf—9678) Analysis of the integrity of the pressure vessel of the BWR type nuclear reactor.** Silva Luna, O. (Instituto Politecnico Nacional, Mexico City. Escuela Superior de Fisica y Matematicas). 1982. 143p. (In Spanish). NTIS (US Sales Only), PC A07/MF A01. File Number DE85781615.

The presssure vessel of a BWR type reactor was monitored for cracking during alternating events of its in-service life. The monitoring was to determine criticality of fractures catastrophic fractures and the velocity of fracture propagation. Detected cracks were evaluated as specified in ASME code section XI, of a minimum wall thickness of 2.5% crack growths were compared a) of 1/10 of the critical maximum size and b) at in-service inspection intervals according to ASME recommendations to be established at the Laguna Verde nuclear plant. Finally conclusions are made and discussed. (author).

46407 **(JAERI-M—84-081) Development tests of an eutectic brazed joint of Zircaloy-4/SUS304.** Shimizu, Kazuo; Yamada, Masaharu; Ara, Katsuyuki; Kitamura, Masayuki. (Japan Atomic Energy Research Inst., Tokyo). May 1984. 53p. (In Japanese). NTIS (US Sales Only), PC A04/MF A01. File Number DE85702192.

This study was conducted for the purpose of developing a Zircaloy-4/SUS304 joint using an eutectic brazing technique. Various fundamental properties of the joint specimens were examined through mechanical tests (tensile tests at room temperature and 300°C, bend tests, burst tests), a thermal cycling test in an autoclave, metallographic tests, and electronprove X-ray microanalysis tests. The results showed that the eutectic brazed joint has a good corrosion resistance in pressurized high-temperature water and steam. A fairly strong joint could be produced by adopting a tapered-surface contact and by controlling brazing-temperature and -time. As a result of these, it has been concluded that the eutectic brazed joint can be used for attaching an in-core instrumentation sensor to, for example, a LWR fuel element.

46408 **(NUREG/CR—4116) NUFREQ-NP: a digital computer code for the linear stability analysis of boiling water nuclear reactors.** Peng, S.J.; Podowski, M.Z.; Lahey, R.T. Jr. (Rensselaer Polytechnic Inst., Troy, NY (USA)). Jul 1985. 437p. NTIS, PC A19/MF A01 - GPO. File Number TI85902159.

The phenomena of nuclear-coupled density-wave oscillations are of considerable importance in boiling water nuclear reactor (BWR) stability analysis. A state-of-the-art linear frequency domain digital computer code, NUFREQ-NP, has been developed for either forced or natural circulation BWR stability analysis. The NUFREQ-NP code can be excited by many external perturbations, including system pressure perturbation. It is based on one dimensional drift-flux thermal hydraulics, and allows for subcooled boiling, arbitrary nonuniform axial and radial power shapes, distributed local losses (e.g., spacers), point or multi-dimensional neutron kinetics, and detailed fuel element dynamics. It has been compared with both out-of-core and in-core data, and good agreement has been found.

## 2102 Power Reactors, Non-breeding, Light-water Moderated, Non-boiling Water Cooled

*REFER ALSO TO CITATION(S) 46403, 46404, 46407, 46440, 46476, 46483, 46500, 46504, 46505, 46506, 46507, 46510, 46512, 46513, 46514, 46517, 46525, 46528, 46531, 46532, 46533, 46534, 46538, 46539, 46542, 46543, 46544, 46546, 46547, 46550, 46551, 46552, 46554, 46557, 46561, 46563, 46564, 46567, 46569, 46571, 46572, 46573, 47294, 47295*

46409 **(BNL-NUREG—36717) Investigation of cracking on a main steam isolation valve shaft from the Farley Unit No. 1 nuclear power plant.** Czajkowski, C.J. (Brookhaven National Lab., Upton, NY (USA)). 1985. Contract AC02-76CH00016. 9p. (CONF-850928—1). NTIS, PC A02/MF A01 - GPO. File Number TI85014824.

From International symposium on contribution of materials investigation to the resolution of problems encountered in PWR plants; Chinon, France (3 Sep 1985).

Chemical analysis of the Farley Unit No. 1 MSIV shaft (No. 69C) showed that the chemical composition of the material was consistent with that expected of a Type 410 stainless steel. The microstructure observed in the base metal (tempered martensite) is consistent with that expected in a Type 410 stainless steel in the quenched and tempered condition. The hardness measurements (both R/sub c/ and Knoop) show that the hardness observed (R/sub c/ 41.3 with a KN max of 459) is significantly higher than that which was anticipated by the heat treatments performed. The cracking was intergranular in nature, occurring along prior austenite grain boundaries. There was not evidence of fatigue interaction on the fracture observed, and no definitive corrodent species identified. The cracking is considered to be an intergranular stress corrosion cracking phenomenon resulting from a high hardness-susceptible material under pressurized water reactor conditions.

46410 (CONF-791122—Absts., pp 45) **Management of radioactive wastes at the Philippine nuclear power plant.** Valdezco, J.I. (National Power Corp., Diliman, Quezon City (Philippines)). 1979. NTIS (US Sales Only), PC A04/MF A01. File Number DE82904129. (INIS-mf—9485).

From 2. Asian regional congress on radiation protection; Manila, Philippines (5 Nov 1979).

Published in abstract form only.

46411 **(DOE/ET/34212—48) Nondestructive examination of an Oconee 1 fuel assembly after five cycles of irradiation.** Newman, L.W.; Papazoglou, T.P.; Mayer, J.T.; McInteer, W.A.; Pyecha, T.D.; Holman, P.L.; Aadland, P.C. (Babcock and Wilcox Co., Lynchburg, VA (USA)). Jul 1985. Contract AC02-78ET34212. 80p. (BAW—1818). NTIS (US Sales Only), PC A05/MF A01; 1; GPO Dep. File Number DE85017703.

Five Babcock & Wilcox Mark B (15 x 15) pressurized water reactor fuel assemblies were nondestructively examined after four cycles of irradiation in the Oconee 1 reactor. Four of the five assemblies examined had a burnup of 40,000 MWd/mtU; the fifth assembly had a burnup of 36,800 MWd/mtU. One of these higher burnup four-cycle assemblies, assembly 1D45, was selected for a fifth cycle of irradiation in cycle 7. Assembly 1D45 achieved 50,160 MWd/mtU burnup during 1553 effective full-power days of incore residence. At the end of cycle 7, assembly 1D45 underwent a nondestructive poolside examination. The examinations were conducted in the Oconee 1 and 2 spent fuel storage pool. Data obtained included fuel assembly and fuel rod dimensions, water channel spacings, spacer grid and holddown spring forces, and crud samples. The results indicate that all five assemblies performed well through four cycles of operation and that assembly 1D45 performed well through five cycles of operation; all of the data were within design limits. 28 refs., 41 figs., 16 tabs.

46412 **(EPRI-NP—4148-Vol.1) ARMP code PWR benchmarking. Volume 1. Zion Unit 2, Cycle 1.** Rothleder, B.M. (Science Applications International Corp., McLean, VA (USA)). Aug 1985. 256p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI85920844.

The Electric Power Research Institute (EPRI) Advanced Recycle Methodology Program (ARMP) has been validated against Cycle 1 measurements made on Commonwealth Edison Company's Zion Unit 2 PWR core. In addition to the usual reaction rate and axial trace measurements for determining power distributions, gamma-scan measurements were available to provide additional data to validate the ARMP model power shapes. Availability of the new ENDF/B-5 library, restricted here to beginning-of-life (BoL), provided this library's first integral reactor test. The EPRI ARMP PWR code sequence closely predicted measured fission detector reaction rate data and La140 gamma-scan data applicable to first cycle power distribution predictability. This code sequence was less successful in modeling power distributions near the reflector boundary than in the core interior. Use of the ENDF/B-5 library in ARMP at BoL resulted in a considerable improvement in reactivity prediction. 8 refs., 159 figs., 21 tabs.

46413 **(EPRI-NP—4209) Additives for pH control in PWR secondary water.** Cobble, J.W.; Turner, P.J. (San Diego State Univ., CA (USA). Dept. of Chemistry). Aug 1985. 143p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI85920845.

The purpose of this project is the development of methods for identifying the most promising materials for use as pH control agents in steam generator and auxiliary hot water systems. The methods developed in the first project year to select new pH control agents have been explored in more detail in an effort to assess and improve their reliability. In addition, some new classes of compounds which were not treatable before have been examined on the basis of new experimental results. Predictions of pH and volatility to 300°C have now been made for a total of 79 organic bases. Some of the newer classes of compounds studied present properties which may make them of interest either as secondary additives or as principal agents in the event of change in the approach to water treatment. While there have been no substantial changes in number of compounds which meet all EPRI criteria, there are other species which may meet the EPRI criteria after further research. 19 refs., 31 tabs.

46414 (INIS-SU—301, pp 56-60) **Calculating the coefficients of thermal reactor characteristics sensitivity to microscopic neutron data errors.** Osipov, V.K.; Tebin, V.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1984. (In Russian). NTIS (US Sales Only), PC A18/MF A01. File Number DE85781590. (CONF-8310228—).

From 6. Soviet national conference on neutron physics; Kiev, USSR (10 Oct 1983).

The SC0CRT program intended for calculation of the reaction rates in the cell of a power heterogeneous reactor is described in brief. The program is plotted on determined algorithm with conservation of main peculiarities of resonance structure of cross sections. The integral equation of neutron transfer is solved using the method of probabilities of first collisions. In high energy range (above 1 MeV) the solution is carried out in group approximation. A generalized subgroup approach permitting to correctly account for deceleration and heterogeneous resonance blocking for resonances of arbitrary width is used in the range of resonance energies for solution of the transfer equation. 26-group library of BNAB-78 constants with additions necessary for realization of the generalized subgroup approach is utilized in the range of neutron moderatiion (above 1 eV). In the range of neutron thermalization the transfer equation is solved in multigroup approximation by the WERTER program. Data on cross sections including matrix of inelastic scattering are prepared by the TERMAK program. 40-group representation of cross sections has been used in the given examples in the range of thermalization (below 1 eV). The results of calculation of sensitivity coefficients of effective coefficient of neutron multiplication and probabiiity of avoiding resonance absorption for regular lattice of the WWER-440 reactor carried out by the SCOCRT program are presented.

46415 **(KFK—3904) HADA. A FORTRAN-IV program for the thermohydraulic design of an advanced pressurized light water reactor with a tight fuel rod lattice.** Dalle Donne, M.; Hame, W. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Neutronenphysik und Reaktortechnik; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Schneller Brueter). Mar 1985. 72p. (EUR—7996e). B. File Number DE85752243.

For the user of the program the input data are described in detail. Two sample runs demonstrate the usage of the program and the output. In addition to the description of the physical background given in KfK 3453, the provided and used solution algorithms are explained. In the last chapters the utility programs are described and an installation guide for the program system is listed.

46416 **(NUREG/CR—3949-Vol.2) Eddy-current inspection for steam generator tubing program. Annual progress report for period ending December 31, 1984. Vol. 2.** Dodd, C.V.; Deeds, W.E.; Smith, J.H.; McClung, R.W. (Oak Ridge National Lab., TN (USA)). Jun 1985. Contract AC05-84OR21400. 12p. (ORNL/TM—9339/V2). NTIS, PC A02/MF A01 - GPO. File Number TI85014818.

Eddy-current inspection is the most suitable method for rapid boreside evaluation of steam generator tubing. However, small flaws can be masked by the effects of harmless variables, such as tube supports. To identify the critical properties accurately and reliably in the presence of extraneous signals caused by variations of unimportant properties, sufficient information is needed to identify harmful variations and reject harmless ones. For this reason we have been developing instrumentation capable of measuring both the amplitude and phase of the eddy-current signal at several different frequencies, as well as computer equipment capable of processing the data quickly and reliably. Our probes and test conditions are also computer-optimized. The most recent probe design embodies an array of small flat "pancake" coils and improves the detection of small flaws and the rejection of tube support signals. We have also experimentally verified the accuracy of our computer programs for calculating the signals produced by defects in tubing and are adapting our new IBM System 9000 computer to take and process the larger amounts of data required by additional variables, such as copper coating and intergranular attack.

46417 **(NUREG/CR—4275) Heavy-Section Steel Technology Program: five-year plan FY 1984-1988.** (Oak Ridge National Lab., TN (USA)). Jul 1985. Contract AC05-84OR21400. 152p. (ORNL/TM—9654). NTIS, PC A08/MF A01 - GPO. File Number TI85013735.

This is the second in the current annual series of five-year program plan documents presented for the Heavy-Section Steel Technology Program. The program is aimed at advancing the un-

derstanding and validation of materials and structures behavior as they relate to light water reactor pressure vessel integrity. The program has nine technical tasks and a management function. A background statement and a plan-of-action is given for each. Lists of reports published by the program are included as part of the background information. The nine technical tasks address fracture methodology and analysis, materials characterization, crack growth, crack arrest, irradiation effects, cladding evaluations, intermediate-vessel testing, thermal-shock testing, and pressurized thermal-shock experiments.

46418 **(PNL-SA—9022) Progress and plans for steam generator integrity research. PWR Steam Generator Tube Integrity Program.** (Pacific Northwest Labs., Richland, WA (USA)). Oct 1980. Contract AC06-76RL01830. 16p. (CONF-801053—16). NTIS, PC A02/MF A01 - GPO. File Number TI85016699.

From 8. water reactor safety research information meeting; Gaithersburg, MD, USA (27 Oct 1980).

The Steam Generator Tube Integrity Program is part of NRC research efforts concerning primary system integrity. Mathematical models have been developed which relate defect geometry and severity in Inconel 600 steam generator tubes to remaining service strength. The types of artificial defects were chosen to simulate known or postulated service degradation. Coupled with the mechanical testing aspects of the program is an extensive nondestructive testing (NDT) effort. Work to date has all been conducted on laboratory simulations of postulated or known service defects. The program has acquired and shipped to the Hanford Reservation (Hanford, Washington) a nuclear steam generator removed from service at the Surry Nuclear Station, operated by Virginia Electric and Power Company.

46419 **(UCRL—84185) Development of load combination for design of nuclear components. Applications of probabilistic methodology.** Ravindra, M.K.; Schwartz, M.; Su, T.Y.; Won, D. (Structural Mechanics Associates, Inc., Newport Beach, CA (USA); Lawrence Livermore National Lab., CA (USA); Sargent and Lundy, Chicago, IL (USA)). Jan 1981. Contract W-7405-ENG-48. 17p. (CONF-810801—33). NTIS, PC A02/MF A01 - GPO. File Number TI85016682.

From 6. international conference on structural mechanics in reactor technology; Paris, France (17 Aug 1981).

In a companion paper, a probabilistic methodology for evaluating in reliability of current design criteria and for developing optimal load combinations for nuclear components has been described. The practical applications of this methodology are illustrated in the present paper. Reliability evaluation of design criteria and generation of optimal design load combinations require that a representative sample of components reflecting different design situations be designed and analyzed. A simulation scheme based on the concept of influence coefficients and using the information from existing designs is herein proposed for obtaining a multitude of characterizations of component designs and thereby avoiding a costly set of design/analyses iterations. Reliabilities implied by the ASME design criteria for Class 2 piping components are evaluated using an example of a segment of Essential Service Water (ESW) piping in a PWR. Optimal values of resistance factors in load combinations for the design of ESW piping systems are derived for specified target limit state probabilities.

46420 **(UCRL—84190) Evaluation of stress histories of reactor coolant loop piping for pipe rupture prediction.** Lu, S.C.; Larder, R.A.; Chan, A.L.; Ma, M.S. (Lawrence Livermore National Lab., CA (USA); URS/John A. Blume and Associates, Engineers, San Francisco, CA (USA); Bechtel Corp., San Francisco, CA (USA)). Jan 1981. Contract W-7405-ENG-48. 11p. (CONF-810801—24). NTIS, PC A02/MF A01 - GPO. File Number TI85016700.

From 6. international conference on structural mechanics in reactor technology; Paris, France (17 Aug 1981).

This paper describes the analyses used to evaluate stress histories in the primary coolant loop piping of a selected four-loop pressurized water reactor nuclear power station (Zion-1). The results of the analyses were used as input to a simulation procedure for predicting pipe rupture probabilities of the reactor coolant system presented by another SMiRT-6 paper J6/6. Sources of stresses considered in the evaluation were pressure, dead weight, thermal expansion, thermal gradients through the pipe wall, residual welding, pump vibrations, and finally seismic excitations. The best estimates of pressure and thermal transient histories arising from plant operations were based on actual plant operation records supplemented by specified plant design conditions. Seismic motions were generated from response spectrum curves developed specifically for the region surrounding the plant site. Stresses due to dead weight and thermal expansion were computed from a three dimensional finite element model which used a combination of pipe, truss, and beam elements to represent the reactor coolant loop piping, the reactor pressure vessel, coolant pumps, steam generators, and the pressurizer. Stresses due to pressure and thermal gradients were obtained by closed form solutions. Seismic stress calculations considered the soil structure interaction, the coupling effect between the containment structure and the reactor coolant system. A time history method was employed for the seismic analysis. Calculations of residual stresses accounted for the actual heat impact, welding speed, weld preparation geometry, and pre- and post-heat treatments. Vibrational stresses due to pump operation were estimated by a dynamic analysis using existing measurements of pump vibrations.

46421 **Trac calculations of overcooling transients in PWRs for pressurized thermal shock analysis.** Ireland, J.R.; Boyack, B.E. (Los Alamos National Lab., NM). pp 587-601 of Anticipated and abnormal plant transients in light water reactors. Volume 1. Lassahn, P.L.; Majumdar, D.; Brockett, G.F. (eds.). New York, NY; Plenum Publishing Corporation (1985).

The overall pressurized thermal shock (PTS) program at Los Alamos with emphasis on TRAC-PF1 calculations of severe overcooling transients in pressurized water reactors (PWRs) is described. Overcooling transients for both the Oconee-1 and Calvert Cliffs-1 nuclear plants have been performed. A summary of results for several calculations are presented for the Oconee-1 PWR along with detailed discussions of two of the most severe overcooling transients predicted [main steam-line break and turbine-bypass valve (TBV) failures]. The calculations performed were plant specific in that details of both the primary and secondary sides were modeled in addition to a detailed model of the plant integrated control system (ICS). For the Oconee-1 main steam-line break transient, a minimum downcomer fluid temperature of $\approx$ 405 K was predicted. For the transient involving the failure of one bank of TBVs to close after initially opening following reactor and turbine trips, an extrapolated downcomer fluid temperature of $\approx$ 365 K was estimated. The latter temperature is at the nil-ductility temperature (NDT) limit ($\approx$ 365 K) for Oconee-1.

## 2103 Power Reactors, Non-breeding, Graphite Moderated

*REFER ALSO TO CITATION(S) 46185, 46485*

46422 **(INIS-mf—9652, pp 43) Neutron physical investigation on the efficiency of an emergency shutdown system in high temperature reactors.** Mueller, H.; Ninaus, W.; Oswald, K.; Schuerrer, F.; Sgouridis, S. (Technische Hochschule, Graz (Austria). Inst. fuer Theoretische Physik und Reaktorphysik); Neef, R.D.; Schaal, H. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorentwicklung). 1984. (In German). NTIS (US Sales Only), PC A07/MF A01. File Number DE85781476. (CONF-8409235—Summ.).

From Annual meeting of the Austrian Physical Society; Leoben, Austria (24 Sep 1984).

Published in summary form only.

46423 **(JAERI-M—83-176) DELIGHT-6: one dimensional lattice burn-up code for high temperature gas-cooled reactors.** Doi, Takeshi; Shindo, Ryuichi; Hirano, Mitsumasa; Takano, Makoto. (Japan Atomic Energy Research Inst., Tokyo). Nov 1983. 128p. (In Japanese). NTIS (US Sales Only), PC A07/MF A01. File Number DE85702169.

The code, DELIGHT-6, performs multi-group neutron spectrum calculation and provides few-group constans for succeeding core calculations. The main objective of the code is to serve as the lattice burn-up code for the core of a very high temperature gas-cooled reactor. The fuel rods of the reactor contain many coated fuel particles resulting double heterogeneous arrangement. The main calculational schema of DELIGHT-6 code is as follows; (1) Energy range for fast neutrons covers from 10 MeV to 2.38 eV and is divided into 61 fine groups. The thermal neutrons covers the rest of the energy range from 2.38 eV to 0 eV. Thermal spectrum is calculated by P1 or P0 approximation with 50 fine groups. (2) To treat resonance absorption, IR method is employed. (3) Zero and one dimensional models are available for the fuel lattice geometry and used for criticality and burn-up calculations. Collision probability method is adopted for the calculation of one dimensional model. (4) Shielding factor of burnable poison is calculated by collision probability method. (5) Other functions of the code are; 1. Spatial shielding factor calculation of $^{240}Pu$, 2. Calculation of neutron streaming effect caused by a gap or a hole in the fuel lattice, 3. Calculation of neutron flux distribution in the fuel lattice by diffusion theory, 4. Calculation of Xe and Sm absorption cross sections with burn-up. (6) Cross section library in both fast and thermal energy range is compiled from ENDF/B-4 except burn-up data of Xe, Sm and pseudo FPs which are supplied by ENDF/B-3. (7) The code provides the macroscopic group constants of fuel lattice with burn-up in CITATION input format.

46424 **(JAERI-M—84-083) Present status on helium technology of HTGR.** Tone, Hirohito; Okamoto, Yoshizo. (Japan Atomic Energy Research Inst., Tokyo). May 1984. 47p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. File Number DE85702200.

Helium technology on HTGR to keep integrity of the reactor structural materials over its life period, to control chemical atmosphere in the coolant helium and to decline radioactivity in the primary system, is important affairs. Details of each systems on helium purification, make-up and gas analysis, which occupy important section of the technology, are surveyed in the case of HTGRs and helium gas loops. Present status of the helium technology rounded off consequence of the survey is described in this paper.

46425 **(JAERI-M—84-088) Distribution of $^{60}Co$ and $^{54}Mn$ in graphite material of irradiated HTGR fuel assemblies.** Hayashi, Kimio; Kikuchi, Teruo; Kobayashi, Fumiaki; Minato, Kazuo; Fukuda, Kousaku; Ikawa, Katsuichi; Iwamoto, Kazumi. (Japan Atomic Energy Research Inst., Tokyo). May 1984. 28p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85702201.

Distribution of $^{60}Co$ and $^{54}Mn$ was measured in the graphite sleeves and blocks of the third and fourth HTGR fuel assemblies irradiated in the Oarai Gas Loop-1 (OGL-1), which is a high temperature inpile gas loop installed in the Japan Materials Testing Reactor (JMTR) of Japan Atomic Energy Research Institute (JAERI). Axial and circumferential profiles were obtained by gamma spectrometry, and radial profiles by lathe sectioning with gamma spectrometry. Distribution of $^{60}Co$ is in good agreement with that of thermal neutron flux, and the Co content in the graphite is estimated to be $\sim 1 \times 10^{-9}$ in weight fraction. Concentration of $^{54}Mn$ decreases toward the axial center in its axial profile, and radially is almost uniform inside and appreciably higher at free surfaces. An estimated Fe content of $\sim 10^{-8}$ in weight fraction is smaller by two orders of magnitude than that from chemical analysis. Higher concentraion of $^{60}Co$ and $^{54}Mn$ at the free surfaces suggests the importance of transportation process of these nuclides in the coolant loop.

46426 **(JAERI-M—84-128) Leakage flow of gases through gaps between contacting surfaces.** Kaburaki, Hideo; Takizuka, Takakazu; Kunugi, Tomoaki. (Japan Atomic Energy Research Inst., Tokyo). Jul 1984. 23p. (In Japanese). NTIS (US Sales Only), PC A02/MF A01. File Number DE85702202.

In the VHTR core which is composed of stacked graphite blocks, leakage flow occurs through gaps between blocks. Since the leakage flow affects the flow distribution in the core, the features of leakage flow between block gaps must be studied. Several leakage flow experiments such as crossflow experiments between fuel block gaps and leakage flow experiments on seal elements were carried out. The purpose of the present experiment, which is one of the series of leakage flow experiments, is to provide information on the basic features of leakage flow through block gaps for the crossflow and the seal element experiments. Measurements were made for leakage mass flow rate and pressure difference across the contacting surfaces of the graphite/graphite and the graphite/metal combinations. The results of the experiment showed that the leakage gas flow through an interface gap between contacting block surfaces was well described by two-dimensional laminar gas flow between parallel plates. The equivalent block gap was evaluated by the present theory.

46427 **(JAERI-M—84-130) Bowing test of HTGR graphite sleeve. Out of pile heat-up experiment and bending test.** Eto, Motokuni; Fujisaki, Katsuo; Yoda, Shinichi; Oku, Tatsuo. (Japan Atomic Energy Research Inst., Tokyo). Jul 1984. 44p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85702203.

Bowing characteristics were examined for IG-11 and H451 graphite sleeve specimens to which temperature gradients were given in the circumferential direction using a specially prepared rig. Measurements were also carried out on load or bending moment which was caused in the sleeve specimens under constraint as a result of temperature gradients. Experimental data were well analyzed on the basis of the elastic theory on the deflection of beams. Bending tests of the sleeve specimens indicated that the bending moment generated in the sleeve specimens under constraint was less than one-third of that at fracture even when the maximum temperature difference along the circumferential direction was more than 200°C.

46428 **(Juel—1976) 2-dimensional modelling of the steam reformer of the ADAM/EVA II facility.** Ferling, C. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorentwicklung; Technische Hochschule Aachen (Germany, F.R.)). Feb 1985. 130p. (In German). NTIS (US Sales Only), PC A07/MF A01. File Number DE85752332.

For the steam reformer of the ADAM/EVA II facility a 2-dimensional computer code is made, which includes local radiation quantities and by-pass circuits. Not only integral sizes (reaction, fission and temperature) and curve states as well as individual tube states are computable by this programme. It is shown that the experimental results compare favorably with this model. For a steam reformer with NTIW-geometry in the 20 MW range the model was changed. Finally an anchor cooling is proposed to release the thermal-mechanical heavily loaded supporting structure. It is possible to describe quantitatively the cooling effect with the plotted computer code. It shows that the anchor wall temperature falls round about 50 K in a 5% cooling circuit. This could prevent the extension of anchors, as well as prolong the lifetime of the bundle and make possible the competence of license.

46429 **(Juel-Spez—299) Experimental investigations concerning the suitability of channel systems for liner leak detection and drainage of a prestressed concrete vessel.** Nickel, M.; Breitbach, G.; Altes, J.; Escherich, K.H.; Wolters, J. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Nukleare Sicherheitsforschung). Feb 1985. 96p. (In German). B. File Number DE85752244.

The iternal surfaces of prestressed concrete pressure vessels are fitted with a steel liner to preserve the gas tightness of the primary circuit. Because of the high quality manufacture and the loading conditions a linear failure can be practically excluded. However, if it is hypothetically assumed, that a leak develops during reactor operation, it may be difficult to determine the position of the leak, because the linear area is very large. For tightness surveillance and for venting channel systems installed in close proximity to the linear are suitable. The suitability of such channels for leak detection, localisation and venting was investigated experimentally. A concrete wall (length 2.5 m, height 2.0 m, thickness 0.5 m) was constructed, covered on one side with a steel liner. Behind the liner two different channel systems have been installed. For the simulation of leaks holes were drilled into the liner. The experimental

programm contained the following measurements: determination of gas flow rates into the different leaks, distribution of leakage gas over the array of channels and determination of pressures into the concrete and immediately behind the liner. The experiments have shown, that channel arrays immediately adjacent to the liner are the most suitable systems for localisation and controlled exhaust of leakage gas. The suitability decreases, if the channels are set into the concrete somewhat distant from the liner.

## 2104 Power Reactors, Non-breeding, Otherwise Moderated Or Unmoderated

*REFER ALSO TO CITATION(S) 46516*

## 2105 Power Reactors, Breeding

*REFER ALSO TO CITATION(S) 46163, 46501, 46536, 46560, 46574, 47983*

**46430 (CONF-850947—3) Status of the breeder fuel cycle in the United States.** Burch, W.D. (Oak Ridge National Lab., TN (USA)). 1985. Contract AC05-84OR21400. 14p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85017090.

From International meeting on solvent extraction and ion exchange in the nuclear fuel cycle; Harwell, UK (3 Sep 1985).

This paper reviews the status and plans for the fast reactor fuel cycle in the United States. The United States is undertaking a complete reexamination of its entire breeder program strategy, and the direction of the new program is not yet clear. Studies in progress to examine the associated fuel cycle strategies as they relate to the overall emerging breeder strategy are described. The present status of and recent developments in the fuel cycle R and D programs are summarized.

**46431 (CONF-851007—1) Verification of steady-state temperature predictions in an instrumented LMFBR driver subassembly.** Betten, P.R.; Feldman, E.E.; Chang, L.K.; Mohr, D.; Planchon, H.P. (Argonne National Lab., IL (USA)). 1985. Contract W-31-109-ENG-38. 5p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85005032.

From 3. international meeting on reactor thermal hydraulics; Newport, RI, USA (15 Oct 1985).

Purpose of this paper is to compare the predicted steady-state coolant temperatures obtained by a thermal-hydraulic computer code with the measured coolant temperatures obtained from the instrumented LMFBR subassembly XX09 during reactor run 129C while the Experimental Breeder Reactor II (EBR-II) was essentially at full power and flow conditions.

**46432 (JAERI-M—84-076) Experimental study of large scale axially heterogeneous LMFBR cores at FCA, (1). Experimental program and critical experiment of FCA assembly XI-2.** Iijima, Susumu; Sanda, Toshio; Okajima, Shigeaki; Nakano, Masafumi. (Japan Atomic Energy Research Inst., Tokyo). Mar 1984. 59p. (In Japanese). NTIS (US Sales Only), PC A04/MF A01. File Number DE85702171.

A series of physics experiments is being carried out at FCA in order to investigate the nuclear characteristics of large scale axially heterogeneous LMFBR cores. The experimental program was decided basing on extensive calculation works. The calculations show that the physics performances of the selected FCA assemblies well simulate those of the axially heterogeneous LMFBR core concerned. The program will be conducted on FCA assemblies XI, XII and XIII. The first version of the cores in the program, FCA XI-2, went critical on February 9, 1984. The FCA XI-2 experiment provides useful comparison with the previous FCA VIII-3 experiment for a prototypescale axially heterogeneous LMFBR core. The present paper describes the calculational works to decide the experimental program, and the critical experiment of FCA XI-2.

**46433 (NIIEFA-OM—0625) Stress-strained state of the magnetic circuit of a cylindrical linear induction pump.** Malkov, A.A.; Spirchenko, Yu.V. (Nauchno-Issledovatel'skij Inst. Ehlektrofizicheskoj Apparatury, Leningrad (USSR)). 1983. 8p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE85702205.

The stress-strained state of the magnetic circuit structures of cylindrical linear induction pumps for the secondary coolant circuit of the BOR-60 reactor is determined. It is shown that when choosing a radial clearance between the inductor and the channel in structures without tread rings (they are used for preventing from magnetic circuits bending) one should take into account magnetic circuit packet deflections from temperature and magnetic forces. Contact forces between the packets and the channel in constructions with tread rings are determined. The formulas for calculating packet deflections are indicated and recommendations for designing magnetic circuits without tread rings are given.

## 2106 Power Reactors, Auxiliary, Mobile, Package, And Transportable

**46434 (LA-UR—85-3005) Predicting fuel performance for SP-100 conditions.** Baars, R.E. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 8p. (CONF-8509153—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85017337.

From 2. SP-100 program integration meeting; Denver, CO, USA (17 Sep 1985).

This paper reports on methods for analyzing fuel designs proposed for the thermionic and thermoelectric concepts for SP-100 application. The proposed fuel design for the thermionic concept consisted of fully-enriched oxide fuel clad in chemical vapor deposition (CVD) tungsten, which also served as the emitter for the thermionic fuel element (TFE). The fuel density was 95% of theoretical with the linear heat rate flattened radially by removing fuel from the center of the fuel pellet. The fuel inner diameter varied from ~0.45 in. at the core center to zero at the edge of the core. The as-fabricated gap between fuel and emitter was 10 mils radial. The emitter thickness was 80 mils, and the outer diameter was 1.099 in. The LIFE-4 code was used for evaluation of this concept after extensive review of the code and development of a procedure that corrects certain deficiencies noted in analysis of several tests.

## 2107 Regulation And Licensing

*REFER ALSO TO CITATION(S) 46442, 46506*

**46435 (INIS-mf—9758, pp vp) Attempt to implement ICRP-26 in the Norwegian legislation.** Woehni, T. 1984. (In Norwegian). NTIS (US Sales Only), PC A08/MF A01. File Number DE85781601. (CONF-8410282—Absts.).

From 7. Nordic Society for Radiation Protection ordinary meeting; Copenhagen, Denmark (10 Oct 1984).

Published in summary form only.

**46436 (NUREG—0020-Vol.9-No.7) Licensed operating reactors: status summary report, data as of June 30, 1985. Volume 9, No. 7.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Resource Management). Aug 1985. 428p. NTIS, PC A19/MF A01 - GPO. File Number TI85902114.

This Status Summary Report provides data on the operation of nuclear units as timely and accurately as possible. This report is divided into three sections: the first contains monthly highlights and statistics for commercial operating units, and errata from previously reported data; the second is a compilation of detailed information on each unit, provided by NRC Regional Offices, IE Headquarters and the Utilities; and the third section is an appendix for miscellaneous information such as spent fuel storage capability, reactor years of experience and non-power reactors in the United States.

46437 (NUREG—0540-Vol.7-No.7) **Title List of Documents Made Publicly Available. Vol. 7, No. 7.** (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Technical Information and Document Control). Aug 1985. 633p. NTIS, PC A99/MF A01 - GPO. File Number TI85902113.

The Title List of Documents Made Publicly Available is a monthly publication. It contains description of the information received and generated by the US Nuclear Regulatory Commission (NRC). This information includes (1) docketed material associated with civilian nuclear power plants and other uses of radioactive materials, and (2) nondocketed material received and generated by NRC pertinent to its role as a regulatory agency. As used here, docketed does not refer to Court dockets; it refers to the system by which NRC maintains its regulatory records. This series of documents is indexed by a Personal Author Index, a Corporate Source Index, and a Report Number Index. This issue covers July 1985.

46438 (NUREG—1142) **Technical specifications: River Bend Station (Docket No. 50-458). Appendix "A" to License No. NPF-40.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Reactor Regulation). Aug 1985. 537p. NTIS, PC A23/MF A01 - GPO. File Number TI85902214.

Limiting conditions for operation and surveillance requirements are presented for the reactvity control systems; power distribution limits; instrumentation; reactor coolant system; emergency core cooling system; containment systems; plant systems; electrical power systems; refueling operations; special test exceptions; radioactive effluents; and radiological environmental monitoring.

46439 (REG/G—1-28-Rev.3) **Quality assurance program requirements (design and construction). Task RS 002-5. Revision 3.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of Nuclear Regulatory Research). Aug 1985. 14p. GPO. File Number TI85901998.

This regulatory guide describes a method acceptable to the NRC staff for complying with regard to establishing and implementing the requisite quality assurance program for the design and construction of nuclear power plants. Guidance for the establishment and execution of quality assurance programs during operation and decommissioning of nuclear power plants have been or will be addressed in separate regulatory guides. Similarly, quality assurance provisions concerning fuel cycle facilities have been or will be addressed in separate regulatory guides.

46440 (NUREG—0386-Digest-No.3-Suppl.1-5) **United States Nuclear Regulatory Staff practice and procedure digest, July 1972-September 1983. No. 3, Supplements 1-5.** (Nuclear Regulatory Commission, Washington, DC (USA). Office of the Executive Legal Director). Jul 1985. 800p. NTIS, PC A99/MF A01 - GPO. File Number TI85902031.

This edition of the NRC Staff Practice and Procedure Digest contains a digest of a number of Commission, Atomic Safety and Licensing Appeal Board, and Atomic Safety and Licensing Board decisions issued during the period from July 1, 1972 to September 30, 1983 interpreting the NRC's Rules of Practice in 10 CFR Part 2. This edition replaces earlier editions and supplements and includes appropriate changes reflecting the amendments to the Rules of Practice effective September 30, 1983. The Digest is roughly structured in accordance with the chronological sequence of the nuclear facility licensing process as set forth in Appendix A to 10 CFR Part 2. Those decisions which did not fit into that structure dealt with in a section on "general matters". Where appropriate, particular decisions are indexed under more than one heading. Some topical headings contain no decision citations or discussion. It is anticipated that future updates to the Digest will utilize these headings.

## 2108 Economics

*REFER ALSO TO CITATION(S) 46611*

46441 (CONF-8506100—4) **Training related research and development conducted at Oak Ridge National Laboratory for the US Nuclear Regulatory Commission.** Haas, P.M. (Oak Ridge National Lab., TN (USA)). 1985. Contract AC05-84OR21400. 9p. NTIS, PC A02/MF A01 - GPO. File Number TI85017153.

From 3. IEEE conference on human factors and power plants; Monterey, CA, USA (23 Jun 1985).

For a number of years Oak Ridge National Laboratory (ORNL) has conducted a sizeable program of human factors research and development in support of the Office of Nuclear Regulatory Research of the US Nuclear Regulatory Commission (NRC). The history of this effort has in many ways paralleled the growth of human factors R and D throughout the nuclear industry and the program has contributed to advances in the industry as well as to NRC regulatory and research programs. This paper reviews the major projects and products of the program relevant to training and concludes with an identification of future R and D needs.

46442 (CONF-8506100—5) **Nuclear power plant simulation facility evaluation methodology.** Haas, P.M.; Carter, R.J.; Laughery, K.R. Jr. (Oak Ridge National Lab., TN (USA); Micro Analysis and Design, Boulder, CO (USA)). 1985. Contract AC05-84OR21400. 4p. NTIS, PC A02/MF A01 - GPO. File Number TI85017152.

From 3. IEEE conference on human factors and power plants; Monterey, CA, USA (23 Jun 1985).

A methodology for evaluation of nuclear power plant simulation facilities with regard to their acceptability for use in the US Nuclear Regulatory Commission (NRC) operator licensing exam is described. The evaluation is based primarily on simulator fidelity, but incorporates some aspects of direct operator/trainee performance measurement. The panel presentation and paper discuss data requirements, data collection, data analysis and criteria for conclusions regarding the fidelity evaluation, and summarize the proposed use of direct performance measurment. While field testing and refinement of the methodology are recommended, this initial effort provides a firm basis for NRC to fully develop the necessary methodology.

## 2109 Process Heat Reactors

*REFER ALSO TO CITATION(S) 45956*

# 22 NUCLEAR REACTOR TECHNOLOGY

46443 (DOE/ER/75172—3) **Western Region American Nuclear Society regional student conference, April 12-14, 1985.** (American Nuclear Society, La Grange Park, IL). 1985. Contract FG02-85ER75172. 47p. (CONF-8504172—Absts.). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85016927.

From Western Region American Nuclear Society student conference; Tucson, AZ, USA (12 Apr 1985).

Abstracts of papers presented at the conference are contained in this proceedings. Topics of technical sessions included fusion and space reactors, numerical and computer modeling, nuclear medicine and radiation effects, and general nuclear technology. (GHT)

## 2201 Theory And Calculation

46444 (CONF-791122—Absts., pp 47) **Two dimensional removal diffusion calculation code for predicting dose rate distribution around the nuclear reactor core.** Kitamura, M.; Uchida, S.; Mitani, S.; Kitazume, M. 1979. NTIS (US Sales Only), PC A04/MF A01. File Number DE82904129. (INIS-mf—9485).

From 2. Asian regional congress on radiation protection; Manila, Philippines (5 Nov 1979).
Published in abstract form only.

46445 **(CTH-RF—46) Heterogenous treatment of water gaps and control rods in core calculations.** Lindahl, S.Oe. (Chalmers Univ. of Tech., Goeteborg (Sweden). Dept. of Reactor Physics). Aug 1984. 78p. NTIS (US Sales Only), PC A05/MF A01. File Number DE85702168.

The conventional fuel assembly homogenization process introduces errors in the gross power distribution of the order of 10%. A method to mitigate the homogenization error is proposed. The gaps in between the fuel pin domains, containing water, control rod blades, fuel channel shroud, etc, are described by their transmission and reflection properties while the fuel pin regions are represented by conventional, homogenized cross sections. A nodal equation, incorporating the gap transmission and reflection functions, is set up in a general form. By numerical testing on 2D core problems it is shown that the explicit gap treatment is capable of reducing the homogenization error by an order of magnitude.

46446 **(EGG-RST—6911) Reactor Systems Technology Division code development and configuration/quality control procedures.** Johnson, E.C. (EG and G Idaho, Inc., Idaho Falls (USA)). Jun 1985. Contract AC07-76ID01570. 36p. NTIS, PC A03/MF A01 - GPO. File Number TI85017467.

Procedures are prescribed for executing a code development task and implementing the resulting coding in an official version of a computer code. The responsibilities of the project manager, development staff members, and the Code Configuration/Quality Control Group are defined. Examples of forms, loga, computer job control language, and suggested outlines for reports associated with software production and implementation are included in Appendix A. 1 raf., 2 figs.

46447 **(INIS-mf—9677) Albedo's determination by the method of neutron impulse.** Flores Calderon, J.E. (Instituto Politecnico Nacional, Mexico City. Escuela Superior de Fisica y Matematicas). 1982. 85p. (In Spanish). NTIS (US Sales Only), PC A05/MF A01. File Number DE85781593.

Tesis (M. in Sci.).

Experiments with non-stationary neutron transport in large cavity moderators ($l >> \Sigma sub(tr)^{-1}$) (where l is the characteristic cavity length and $\Sigma sub(tr)^{-1}$ the macroscopic transport section of the moderator) led to the method reported in this study which, based on neutron impulses for determining albedo of thermal neutrons, gave a precision greater by an order of magnitude over previous methods. A sufficient time interval after introduction of the neutron flux into the moderator chamber decreased exponentially the decay constant L, which was itself related to albedo by a function called f. Numerical calculations of albedo were assisted. (author).

46448 (INIS-SU—301, pp 61-72) **Evaluating the parameters of reactor structure materials absorption by means of a new kind integral experiments.** Bemer, B.; Dittse, K.; Fehrrann, K.; Khyuttet', G.; Kumpf, G.; Lemann, E. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)). 1984. (In Russian). NTIS (US Sales Only), PC A18/MF A01. File Number DE85781590. (CONF-8310228—).

From 6. Soviet national conference on neutron physics; Kiev, USSR (10 Oct 1983).

Integral experiment of a new type is conducted for determination of the effective cross sections of structural material absorption in fast reactors. Its essence is that absorption cross sections are determined directly from the measured central coefficients of reactivities in the special fast inserting lattice SEG-4 with energy-independent neutron importance function. Parameters of the system, method of measurements, advantages of the method as compared with Ksub(infinity)=1 method are described. The results of measurements for Fe, Cr, Ni, Mn, Mo and W are presented. Problems of mass dependence of the sample are discussed. Conclusion on universality of the suggested method is made on the basis of comparing the obtained results with data of calculations conducted by using different libraries of nuclear data.

46449 (INIS-SU—301, pp 73-79) **Analysis of the zero power reactor experiments to check the constants for thermal reactor calculation.** Yudkevich, M.S. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1984. (In Russian). NTIS (US Sales Only), PC A18/MF A01. File Number DE85781590. (CONF-8310228—).

From 6. Soviet national conference on neutron physics; Kiev, USSR (10 Oct 1983).

The results of precise calculations of characteristics of critical assemblies are analyzed. Neutron-physical $^{235}U$ and $^{238}U$ constants intended for calculation of thermal reactors are presented.

46450 (INIS-SU—301, pp 18-35) **Nuclear data requirements for fast reactors.** Manokhin, V.N.; Usachev, L.N. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.). 1984. (In Russian). NTIS (US Sales Only), PC A18/MF A01. File Number DE85781590. (CONF-8310228—).

From 6. Soviet national conference on neutron physics; Kiev, USSR (10 Oct 1983).

Papers deating with determination of purpose accuracies of neutron data used in development of fast reactors are reviewed. Data on purpose accuracies of effective coefficient of neutron multiplication, breeding ratio, change in reactivity during the operating period, reactivity of control rods, heat release, radiation damage effects, reactivity coefficients, residual heat release and activity of irradiated materials are systematized. Technique for determination of requirements to accuracy of microscopic nuclear data and approached accuracy of determining microscopic constants of the basic fission and fertile isotopes, structural materials and absorbers are considered. It is concluded that precise determination of correlation properties of permissible parameters is necessary for effective attainment of purpose accuracies of reactor parameters.

46451 **(JAERI-M—83-202) Thermal reactor benchmark tests on JENDL-2.** Takano, Hideki; Tsuchihashi, Keichiro; Yamane, Tsuyoshi; Akino, Fujiyoshi; Ishiguro, Yukio; Ido, Masaru. (Japan Atomic Energy Research Inst., Tokyo). Nov 1983. 48p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. File Number DE85702170.

A group constant library for the thermal reactor standard nuclear design code system SRAC was produced by using the evaluated nuclear data JENDL-2. Furthermore, the group constants for $^{235}U$ were calculated also from ENDF/B-V. Thermal reactor benchmark calculations were performed using the produced group constant library. The selected benchmark cores are two water-moderated lattices (TRX-1 and 2), two heavy water-moderated cores (DCA and ETA-1), two graphite-moderated cores (SHE-8 and 13) and eight critical experiments for critical safety. The effective multiplication factors and lattice cell parameters were calculated and compared with the experimental values. The results are summarized as follows. (1) Effective multiplication factors: The results by JENDL-2 are considerably improved in comparison with ones by ENDF/B-IV. The best agreement is obtained by using JENDL-2 and ENDF/B-V (only $^{235}U$) data. (2) Lattice cell parameters: For the $rho_{28}$ (the ratio of epithermal to thermal $^{238}U$ captures) and C* (the ratio of $^{238}U$ captures to $^{235}U$ fissions), the values calculated by JENDL-2 are in good agreement with the experimental values. The $rho_{28}$ (the ratio of $^{238}U$ to $^{235}U$ fissions) are overestimated as found also for the fast reactor benchmarks. The $rho_{02}$ (the ratio of epithermal to thermal $^{232}Th$ captures) calculated by JENDL-2 or ENDF/B-IV are considerably underestimated. The functions of the SRAC system have been continued to be extended according to the needs of its users. A brief description will be given, in Appendix B, to the extended parts of the SRAC system together with the input specification.

46452 (JAERI-M—84-010, pp 123-137) **Sensitivity analysis for production and depletion of nuclides.** Mitani, Hiroshi (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). Mar 1984. (In Japanese). NTIS (US Sales Only), PC A13/MF A01. File Number DE84901547. (CONF-8311187—; NEANDC(J)—97/AU; INDC(JPN)—84/G).

From JAERI seminar on nuclear data; Tokai, Japan (30 Nov 1983).

An eigenvalue-method is applied to solving real and adjoint equations for production and depletion of nuclides. The cyclic chain in the decay scheme of actinides can be treated accurately and the existence of complex eigenvalues is also shown. The sensitivity coefficients of actinide production and depletion in a 1000 MWe fast reactor are strongly dependent on the type of Pu fuel used, i.e. Pu fuel from BWR or Pu fuel from blanket of FBR. The sensitivity coefficients due to variations of capture cross sections, $\sigma$sub(n,2n) of $^{238}$U, lambda sub($\beta$) of $^{241}$Pu and lambda sub($\alpha$) of $^{242}$Csub(m) are especially large.

**46453 (JAERI-M—84-110) Benchmark calculations of the solution-fuel criticality experiments by SRAC code system.** Senuma, Ichiro; Miyoshi, Yoshinori; Suzaki, Takenori; Kobayashi, Iwao. (Japan Atomic Energy Research Inst., Tokyo). Jun 1984. 55p. (In Japanese). NTIS (US Sales Only), PC A04/MF A01. File Number DE85702175.

Benchmark calculations were performed by using newly developed SRAC (Standard Reactor Analysis Code) system and nuclear data library based upon JENDL-2. The 34 benchmarks include variety of composition, concentration and configuration of Pu homogeneous and U/Pu homogeneous systems (nitrate, mainly), also include $UO_2/PuO_2$ rods in fissile solution: a simplified model of the dissolver process of the fuel reprocessing plant. Calculation results shows good agreement with Monte Carlo method. This code-evaluation work has been done for the the part of the Detailed Design of CSEF (Critical Satety Experimental Facility), which is now in Progress.

**46454 (JAERI-M—84-127) Evaluation of autoregressive model fitting algorithms based on least squares method.** Hayashi, Koji. (Japan Atomic Energy Research Inst., Tokyo). Jul 1984. 51p. (In Japanese). NTIS (US Sales Only), PC A04/MF A01. File Number DE85702176.

This report is concerned with the numerical evaluation of two algorithms, i.e. the Marple's and the Kitagawa-Akaike's for autoregressive model fitting based on least squares method. Simulation study on these algorithms was performed using three types of test data which were sampled from sinusoidal signals with and without additive white noise. The results show that these algorithms are superior in the following points to the conventional algorithms, i.e. the Yule-Walker's and the Burg's. 1) Even in case where the sampled data contains the strong periodic components, its numerical results are stable and also physically consistent. 2) Frequency bias errors in AR spectral peaks which occur in case of fitting to small number of sampled data are very small.

**46455 (KAERC—6/84) Purity determination of nuclear materials by pile oscillator technique.** Li Song Won; Han Jong Ha; Kim Su Myong; Chon Myong San; Hong Sung Mu. (State Committee for Atomic Energy, Pyongyang (D.P.R. of Korea). Research Center for Atomic Energy.). Aug 1984. 4p. (In Korean). NTIS (US Sales Only), PC A02/MF A01. File Number DE85702177.

In the paper is described a method of purity measurement of nuclear materials by the pile oscillator technique. Considered also are the most suitable experimental condition, the characteristics of experimental equipment, the measuring technique and the self-shielding and length effects of samples.

**46456 (PNL-SA—13190) ELCAP: measurement plans and equipment installation.** Mazzucchi, R.P.; Sandusky, W.F.; Schuldt, M. (Pacific Northwest Labs., Richland, WA (USA); United Industries Corp., Bellevue, WA (USA)). Apr 1985. Contract AC06-76RL01830. 16p. (CONF-850175—6). NTIS, PC A02/MF A01; GPO Dep. File Number DE85017899.

From EPRI end-use metering workshop; Seattle, WA, USA (15 Jan 1985).

Based on the problems noted in the pilot study, it was apparent that several changes were needed. First, the procedures for preparing the measurement plan and installing the metering equipment have been expanded to provide a checklist for various task activities. Second, more illustrations have been placed in the procedures to show the configuration of the equipment and to identify various checkpoints in the FDAS. These checklists provide repetitive checks that allow some measure of contractor quality-control checking. Some additional procedures have also been generated. For example, if the measurement plan is altered by the installation team to overcome installation problems, such as changing the recommended current transformer (CT) size, an Installation Change Notice (ICN) form is completed. A standard load test was developed to catch installation problems, such as misoriented or misplaced CTs, improper scaling resistors, and CTs with reversed leads. This procedure requires the installation team to subject each CT to a known current. The CT output is then monitored via a communication link with a portable computer to determine if the same approximate current is observed. This information is typically sent over the dedicated telephone line to a portable computer at PNL, and provides the additional assurance that the communication link with the laboratory exists, and the system functions as planned. The installation contractor now provides an initial review and cost estimate for generating a measurement plan and completing the installation for each building. During this initial visit, various obstacles to completing the installation or metering program are listed by the contractor for review by PNL staff. If these obstacles are deemed to be excessive or to markedly increase the cost of the installation effort, the building will be rejected.

## 2202 Components And Accessories

**46457 (CONF-850809—75) Development of high-strength concrete mix designs in support of the prestressed concrete reactor vessel design for a HTGR steam cycle/cogeneration plant.** Naus, D.J.; Oland, C.B. (Oak Ridge National Lab., TN (USA)). 1985. Contract AC05-84OR21400. 9p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016310.

From 8. international conference on structural mechanics in reactor technology; Brussels, Belgium (19 Aug 1985).

Design optimization studies indicate that a significant reduction in the size of the PCRV for a 2240 MW(t) HTGR plant can be effected through utilization of high-strength concrete in conjunction with large capacity prestressing systems. A three-phase test program to develop and evaluate high-strength concretes (>63.4 MPa) is described. Results obtained under Phase I of the investigation related to materials selection-evaluation and mix design development are presented. 3 refs., 4 figs.

**46458 (CONF-850809—76) Testing of plain and fibrous concrete single cavity prestressed concrete reactor vessel models.** Oland, C.B. (Oak Ridge National Lab., TN (USA)). 1985. Contract AC05-84OR21400. 9p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016311.

From 8. international conference on structural mechanics in reactor technology; Brussels, Belgium (19 Aug 1985).

Two single-cavity prestressed concrete reactor vessel (PCRV) models were fabricated and tested to failure to demonstrate the structural response and ultimate pressure capacity of models cast from high-strength concretes. Concretes with design compressive strengths in excess of 70 MPa (10,000 psi) were developed for this investigation. One model was cast from plain concrete and failed in shear at the head region. The second model was cast from fiber reinforced concrete and failed by rupturing the circumferential prestressing at the sidewall of the structure. The tests also demonstrated the capabilities of the liner system to maintain a leak-tight pressure boundary. 3 refs., 4 figs.

**46459 (EGG-MS—6843) Weld energy reduction by using concurrent nondestructive evaluation. Final report.** Johnson, J.A.; Carlson, N.M.; Watkins, A.D. (EG and G Idaho, Inc., Idaho Falls (USA)). May 1985. Contract AC07-76ID01570. 58p. NTIS, PC A04/MF A01; GPO Dep. File Number DE85017472.

In-process inspection of partially completed welds is shown to be feasible and to have the potential of large economic and productivity improvements in certain circumstances. Ultrasonic inspection of the weld and analysis by an automatic pattern-recognition system has a flaw detection rate of 90 to 95% with a false call rate of about 8%. The pattern-recognition system uses cues that human

observers use to discriminate between good and flawed weld. The system has the potential to discriminate among types of flaws. An application analysis shows a potential savings of over $21 per foot of weld on two in. thick plates such as used for pressure vessel fabrication. 5 refs., 15 figs., 8 tabs.

46460 **(INIS-mf—9356) Onward development of nondestructive testing methods for inservice inspection of reactor power plants. Final report.** Seiger, H. (comp.). (Krautkraemer G.m.b.H., Koeln (Germany, F.R.)). [1985]. 225p. (In German). NTIS (US Sales Only), PC A10/MF A01. File Number DE85781611.

The studies so far centered on hardware and software developments to improve ultrasonic detection and analysis. The state of the art of an ultrasonic probe with variable acoustic field parameters and control device, of reflector detection from the transit time, and of probe stability is reviewed in particular. With the present active probes for thick welds (vibrating material, vibration damping), reliable stability control on the basis of pulse monitoring cannot be ensured. (DG).

46461 **(JAERI-M—84-122) Study on fatigue life evaluation of structural component based on crack growth criterion.** Shibata, Katsuyuki. (Japan Atomic Energy Research Inst., Tokyo). Jul 1984. 135p. (In Japanese). NTIS (US Sales Only), PC A07/MF A01. File Number DE85702178.

As one of the practical application of fracture mechanics, fatigue life evaluation method based on crack growth criterion has been diffusing in various field of technology in order to determine the rational and reliable life of structural components. The fatigue life by this method is evaluated based on the fatigue crack growth analysis from defects, while many problems, such as the influence of residual stress on the crack growth behavior, the effect of overloading, and evaluation method for multiple surface cracks, are not sufficiently solved yet. In this paper, the above problems are treated, and based on some experimental data some simple methods for fatigue life evaluation are proposed regarding the above problems. Verification of the proposed methods are shown in the paper by comparing with some experimental results, and the applicability of the proposed method is also examined by the fatigue test of pipes with cracks in the inner surface.

46462 **(Juel—1979) Experiments with tubes made of INCOLOY 800H under uniaxial and multiaxial loading conditions.** Roedig, M.; Penkalla, H.J.; Franzke, K.; Schubert, F.; Nickel, H. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorwerkstoffe). Feb 1985. 66p. (In German). NTIS (US Sales Only), PC A04/MF A01. File Number DE85752331.

In order to verify the transferability of materials data and constitutive equations in the high temperature region, uniaxial and multiaxial creep tests were performed with tubes made of X10 NiCrAlTi 32 20 (INCOLOY 800H). The tubes were loaded by a combination of tension, internal pressure and torsion. The temperature was 950°C. The life-time of the heat exchanger tubes under pure uniaxial tension was found to be longer than the time to rupture of bar material made from the same parent heat. The heat exchanger tubes show a significant creep hardening in the primary creep range and a later onset of the secondary creep range. For the heat exchanger tubes under different multiaxial loading conditions different life times were measured, although in all cases the same deviatoric stress (v. Mises) was used. For the experiments presented in this paper these differences can be explained by constitutive equations. The deformation of the heat exchanger tubes under multiaxial loadings cannot be predicted by the postulated mathematical model. In the experiments with combined loading conditions the tubes failed by leak formation and fracture respectively - a spontaneous failure was never found.

46463 **(SKI-B—48-83) Further development of numerical methods for the study of rapid crack propagation and for crack arrest in reactor pressure vessels.** Oliveira, R.; Brickstad, B. (Swedish Nuclear Power Inspectorate, Stockholm; Royal Inst. of Tech., Stockholm (Sweden). Dept. of Strength of Materials and Solid Mechanics). Jul 1983. 17p. (In Swedish). (TRITA-HFL—48). NTIS (US Sales Only), PC A02/MF A01. File Number DE85702179.

Whether an existing crack is a menace to the function and safety of a construction, is a primary problem. In important construction as the pressure vessels of nuclear power plants, it is important to prevent a catastrophical growth of cracks. This second problem is especially important as inspection as a means for identification of crack initiation is difficult. Numerical analysis by finite element methods for crack dynamics has been further developed, with nuclear pressure vessels in mind. The programmes allow analysis of rapid crack propagation in linear thermoelastic materials in plane structures. Some results are even attained for axi-symmetric crack growth. The analysis give the stress intensity factor for a known crack history, or may predict crack growth from fracture characteristics of the material.

46464 **(UCRL—84183) Derivations of load factors for design of nuclear power plant components.** Schwartz, M.W. (Lawrence Livermore National Lab., CA (USA)). Jan 1981. Contract W-7405-ENG-48. 17p. (CONF-810801—31). NTIS, PC A02/MF A01 - GPO. File Number TI85016684.

From 6. international conference on structural mechanics in reactor technology; Paris, France (17 Aug 1981).

This paper introduces the concept of probabilistic design of nuclear power plant components and illustrates the methodology and usefulness of the concept with a simple example. It discusses the fundamental relationship between load and resistance factors associated with load combination formats that may be used for design. The simple example consists of a simple supported pipe subjected simultaneously to internal pressure, dead weight and a velocity transient. Associated with each of these loads is a coefficient or load factor whose value is governed by the dispersion of the loading magnitudes and the desired reliability level of the component. The task is to find the optimal set of load factors which results in a design having a specified target reliability. The load factors were derived using an ensemble of forty combinations of pipe length and diameter and were evaluated for target limit state probabilities ranging from $10^{-2}$ to $10^{-6}$. For the entire array of pipes designed with these loads factors (that is, determining their thickness) the actual limit state probabilities ranged from $1.003 \times 10^{-2}$ for the $10^{-2}$ target to $1.076 \times 10^{-6}$ for the $10^{-6}$ target. The mean limit state probability for the ensemble of pipes designed in accordance with NB.3652 of the ASME Code was $2.571 \times 10^{-3}$ with a coefficient of variation of 0.859. Designs executed with load factors to meet a target limit state probability of $10^{-3}$ had a coefficient of variation of only 0.107. This demonstrates that the use of probabilistically derived load factors can result in designs having both assured and more consistent levels of probability.

46465 **NDE reliability assessment.** Doctor, S.R. (Pacific Northwest Lab., Richland, WA (USA)). pp 323-335 of Nondestructive examination for pressurised components. Proceedings of the 3. international seminar on 'Non-destructive examination in relation to structural integrity' held in Monterey, California, USA, 30-31 August 1983, in conjuction with the 7. international conference on structural mechanics in reactor technology. Nichols, R.W. (International Council of Pressure Vessels and Piping (Europe)); Dau, G.J. (Electric Power Research Inst., Palo Alto, CA (USA)) (eds.). Barking, England; Elsevier Applied Science Publishers Ltd. (1984). (CONF-830868—). Contract AC06-76RL01830.

From 3. international seminar on assuring structural integrity of steel reactor pressure boundary components; Monterey, CA, USA (29 Aug 1983).

Price Pound 55.00.

The PNL Pipe Inspection Round Robin (PIRR) test was conducted in order to measure the reliability of crack detection by ultrasonic testing (UT) in reactor coolant piping with six teams from commercial in-service inspection organizations. These teams conducted a total of 1500 pipe inspections, using their own field inspection procedures and also a procedure written by PNL. The PNL procedure was based on ASME Code Case N-335. Results of crack detection is expressed in terms of recording probability, probability of detection and false call rates. It is concluded that the inspection of clad ferritic material with or without weld metal can be 100% effective if adequate sensitivity is used. However the inspection of thermal fatigue cracks in centrifugally cast stainless steel is ineffective using conventional manual ultrasonic techniques. The in-

spection of wrought stainless steel is only marginally effective. Crack length sizing was non-conservative for long cracks. Crack depth sizing was found to be inaccurate.

## 2203 Fuel Elements

46466 **(CONF-850810—25) Heat transfer near spacer grids in rod bundles.** Yoder, G.L. (Oak Ridge National Lab., TN (USA)). 1985. Contract AC05-84OR21400. 11p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85016312.

From National heat transfer conference; Denver, CO, USA (4 Aug 1985).

Heat transfer data from several sources have been assembled which show the effect of spacer grids on local heat transfer within a rod bundle. Both single phase (air and steam) data and two phase (steam/water) data show heat transfer augmentation in the grid region. Heat transfer improvement immediately beyond the grid ranges from a few percent to over fifty percent in these experiments, depending on flow conditions. The data are examined using several nondimensional parameters which relate the above effects to known quantities. The relative effect of the grid on local heat transfer is altered by both the Reynolds number and blockage ratio. Twenty to thirty hydraulic diameters are required before the local effect of the grid dissipates. Locally, both the single phase and two phase data show the same trends. Comparison of the single and two phase data also shown some differences. Some film boiling data indicate that an altered heat transfer regime may exist near the grid. High rod heat transfer coefficients at the grid locations indicate either a rewet of the rods or at least a change from film boiling to transition boiling near the spacer. The comparison also indicates that the film boiling data is affected on a global as well as local basis. This is due to the effect of the grid on the liquid distribution.

46467 (INIS-mf—9742, pp 96-106) **Autoradiographic determination of distribution of nuclear fuel components.** Golenishchev, I.A.; Grachev, A.V.; Isaev, I.G.; Kuz'min, A.A.; Lyubakov, V.N.; Majorov, A.N.; Yampol'skij, V.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow). 1983. (In Russian). NTIS (US Sales Only), PC A12/MF A01. File Number DE85781598. (CONF-8305206—).

From 13. international symposium on autoradiography; Tabor, Czechoslovakia (2 May 1983).

In order to determine the uniform distribution of $PuO_2$ in nuclear fuel alpha autoradiography was used. Alpha radiation is detected using track detectors. The frequency contrast characteristic is discussed of autoradiograms for various areas of the boundary function. In order to increase the contrast of imaging the detectors are dyed with rhodamine. The alpha autoradiography unit is briefly described. The unit consists of a facility for tablet grinding and polishing, a facility for detector exposure and leaching and a television image analyser. (E.S.).

46468 **(PNL-SA—9017) FRAPCON-2 structure and results.** Lanning, D.D.; Rausch, W.N. (Pacific Northwest Labs., Richland, WA (USA)). Oct 1980. Contract AC06-76RL01830. 25p. (CONF-801053—15). NTIS, PC A02/MF A01. File Number TI85016697.

From 8. water reactor safety research information meeting; Gaithersburg, MD, USA (27 Oct 1980).

The NRC-sponsored steady-state fuel rod modeling work at INEL and PNL has been integrated since the production of FRAPCON-1 in 1979. FRAPCON-1 is a steady-state single-rod code which proved during "independent assessment" comparison to in-reactor data to have the same shortcomings as its predecessors (FRAPS-3, GAPCON-3). Among these were overprediction of measured fuel temperatures and underprediction of fuel rod axial elongation. The Fuel Behavior Research Branch authorized and sponsored a second version, FRAPCON-2, to be developed jointly by PNL and INEL. FRAPCON-2 includes a much larger variety of both mechanical and thermal models.

46469 **(PNL-SA—9021) Recent studies on gap conductance and fuel stored energy.** Lanning, D.D. (Pacific Northwest Labs., Richland, WA (USA)). 1980. Contract AC06-76RL01830. 27p. (CONF-801053—10). NTIS, PC A03/MF A01 - GPO. File Number TI85016698.

From 8. water reactor safety research information meeting; Gaithersburg, MD, USA (27 Oct 1980).

Ex-reactor measurements of gap conductance vs pressure show a 50-100% conductance increase as the pressure increases from 0.1 to 1.0 MPa, but little change with further pressure increase. This behavior is corroborated by in-reactor measurements and qualitatively predicted by current gap conductance models. Quantitative and detailed comparison between models and the well-controlled ex-reactor experiments, however, is poor, especially for helium. In-reactor measurements of fuel temperature have shown inferred effective gap conductance consistently higher than those calculated by standard fuel performance codes, when these include no fuel relocation. Steady-state measurements at PBF, and transient measurements at Halden, have further shown that fuel relocation and gap conductance enhancement is accompanied by fuel thermal conductivity degradation. Additionally, gap conductance does not appear to be a strong function of fuel power/temperature. The impact of fuel cracking/relocation/thermal conductivity degradation upon peak LOCA cladding temperature is only significant for a high-resistance, fission-gas saturated rod. Even for these conditions, the increase in calculated peak cladding temperature due to adopting a cracked pellet model is probably less than 50°K.

46470 **(SKI-B—26-81) Experimental manufacturing of fuel rod simulators with instrument outfit for Fix-II. Final report on SKI commission B 26/81.** Nilsson, L.; Gustafson, L. (Swedish Nuclear Power Inspectorate, Stockholm; Studsvik Energiteknik AB, Nykoeping (Sweden)). Aug 1984. 30p. (In Swedish). (STUDSVIK-NR—84-459). NTIS (US Sales Only), PC A03/MF A01. File Number DE85702180.

The length of life of the earlier samples of simulators for the bundle of 36 fuel rods was estimated to be limited. A number of reserve rods have been manufactured and quality control has been performed on 6 complete rods. Improvements have been made in comparison with the earlier samples which displayed a scattering of stage dimensions and power factors. The mounting of thermocouples also caused breakdowns. New manufacturing methods are described.

46471 **(SRD-R—278) Modelling of fission gas release from fuel undergoing isothermal heating.** Brearley, I.R.; MacInnes, D.A. (UKAEA Safety and Reliability Directorate, Culcheth). May 1983. 11p. United Kingdom Atomic Energy Authority, Wigshaw Lane, Culcheth Warrington, England. File Number TI85901927.

Currently there is much discussion of the mechanism of fission gas release from fuel subjected to transient heating. A recent model (SINGAR) suggests that the release mechanism is principally single atom migration coupled with thermal resolution of atoms from intragranular bubbles. This contrasts with the previous interpretation of the release in terms of biased gas bubble migration in the presence of a temperature gradient. Here we model successfully the extensive release observed during isothermal annealing of irradiated fuel samples. This is major evidence in favour of the SINGAR model, since in the absence of a temperature gradient, the bubble migration model will predict no release, contrary to observation. 14 refs., 4 tabs.

46472 **Apparatus for in situ determination of burnup cooling time and fissile content of an irradiated nuclear fuel assembly in a fuel storage pond.** Phillips, J. R.; Halbig, J. K.; Klosterbuer, S. F.; Menlove, H. O. (to The United States of America as represented by the Department of Energy). US Patent 4,510,117. 9 Apr 1985. Filed date 10 Feb 1983. vp. PAT-APPL-465419.

A detector head for in situ inspection of irradiated nuclear fuel assemblies submerged in a water-filled nuclear fuel storage pond. The detector head includes two parallel arms which extend from a housing and which are spaced apart so as to be positionable

on opposite sides of a submerged fuel assembly. Each arm includes an ionization chamber and two fission chambers. One fission chamber in each arm is enclosed in a cadmium shield and the other fission chamber is unshielded. The ratio of the outputs of the shielded and unshielded fission chambers is used to determine the boron content of the pond water. Correcting for the boron content, the neutron flux and gamma ray intensity are then used to verify the declared exposure, cooling time and fissile material content of the irradiated fuel assembly.

46473 **Characterization of aerosols from industrial fabrication of mixed-oxide nuclear reactor fuels.** Hoover, M.D.; Newton, G.J.; Yeh, H.C.; Edison, A.F. (Lovelace Inhalation Toxicology Research Institute, Albuquerque, NM). pp 533-548 of Aerosols in the mining and industrial work environments. Volume 2. Characterization. Marple, V.A.; Liu, B.Y.H. (eds.). Ann Arbor, MI; Ann Arbor Science Publishers (1983). Contract AC04-76EV01013.

Information on the characteristics of aerosols in three industrial facilities during fabrication of uranium and plutonium mixed-oxide reactor fuels is summarized. Aerosol characterization included measurements of air concentrations particle size distributions, particle morphology, aerosol electrostatic charge characteristics and in vitro dissolution. These were the physicochemical properties considered most relevant to evaluating the consequences of potential accidents wherein aerosols might be released from their normal containment and inhaled by workers. Alpha radioactivity concentrations in air ranged about 1-15,000 nCi/l, depending on the fabrication step and facility. Particle size distributions were approximately log-normal, and activity median aerodynamic diameter (AMAD) ranged 1.6-3.5 μm, with a geometric standard deviation of about 1.6. Electron microscopy indicated that particles were irregularly shaped agglomerates. In vitro dissolution half-times were on the order of years, with some dependence on aerosol size, temperature history and fabrication step. No unique potential exposure conditions were found in any step of the fabrication processes.

## 2204 Control Systems

46474 **(CONF-850996—4) Nuclear power plant training simulator fidelity assessment.** Carter, R.J.; Laughery, K.R. (Oak Ridge National Lab., TN (USA); Micro Analysis and Design, Boulder, CO (USA)). 1985. Contract AC05-84OR21400. 14p. NTIS, PC A02/MF A01. File Number TI85017082.

From 29. Human Factors Society annual meeting; Baltimore, MD, USA (30 Sep 1985).

The fidelity assessment portion of a methodology for evaluating nuclear power plant simulation facilities in regard to their appropriateness for conducting the Nuclear Regulatory Commission's operating test was described. The need for fidelity assessment, data sources, and fidelity data to be collected are addressed. Fidelity data recording, collection, and analysis are discussed. The processes for drawing conclusions from the fidelity assessment and evaluating the adequacy of the simulator control-room layout were presented. 3 refs.

46475 **(JAERI-M—84-056) Diagnosis of NSRR based on reactor noise analysis, (1).** Hayashi, Koji; Shimazaki, Junya; Watanabe, Koichi; Shinohara, Yoshikuni; Suzukawa, Yoshihiro; Ohtomo, Shoichi; Uno, Hisao; Yachi, Shigeyasu; Horiki, Ohichiro. (Japan Atomic Energy Research Inst., Tokyo). Mar 1984. 65p. (In Japanese). NTIS (US Sales Only), PC A04/MF A01. File Number DE85702181.

This report is concerned with the diagnostic experiments (Phase-I) which has been made to investigate the cause of remarkable changes in reactor power of NSRR. The Phase-I experiment was performed with the aim to clarify the present state of NSRR from the view point of reactor noise analysis. Through the observation of signal recordings and spectral analysis, it has been found that the reactor power changes consist of the signal components which can be classified into three patterns and that these changes are related with the instability of the automatic control system.

46476 **(JAERI-M—84-084) Method of signal transmission path analysis for multivariate random processes.** Oguma, Ritsuo. (Japan Atomic Energy Research Inst., Tokyo). Apr 1984. 28p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85702182.

A method for noise analysis called "STP (signal transmission path) analysis" is presentd as a tool to identify noise sources and their propagation paths in multivariate random processes. Basic idea of the analysis is to identify, via time series analysis, effective network for the signal power transmission among variables in the system and to make use of its information to the noise analysis. In the present paper, we accomplish this through two steps of signal processings; first, we estimate, using noise power contribution analysis, variables which have large contribution to the power spectrum of interest, and then evaluate the STPs for each pair of variables to identify STPs which play significant role for the generated noise to transmit to the variable under evaluation. The latter part of the analysis is executed through comparison of partial coherence function and newly introduced partial noise power contribution function. This paper presents the procedure of the STP analysis and demonstrates, using simulation data as well as Borssele PWR noise data, its effectiveness for investigation of noise generation and propagation mechanisms.

46477 **(KAERC—3/84) Automatic-control system of critical reactor.** Kim Bong Bin; Kim Chol; Kim Jong Im. (State Committee for Atomic Energy, Pyongyang (D.P.R. of Korea). Research Center for Atomic Energy.). Aug 1984. 7p. (In Korean). NTIS (US Sales Only), PC A02/MF A01. File Number DE85702183.

In this paper is described the control system developed for the physical and automatical experiment in the nuclear reactor. The control system is the one in which the period and power are functionally combined for the starting and operation of the reactor. The paper also treats on the scientific results evaluated in the analytical model and test stage. The correlation of the given value of the control period, the cut-off point of the control channel, amplification factor and reactivity of the control rods to the transient response are shown.

46478 **(PTB-Me—66) Calibration of an ultrasonic flow meter and investigation of its behaviour under certain conditions when built in.** Kalkhof, H.G.; Hajek, W. (Physikalisch-Technische Bundesanstalt, Braunschweig (Germany, F.R.). Abt. Mechanik). Jan 1985. 25p. (In German). Physikalisch-Technische Bundesanstalt, Braunschweig, Germany, F.R.

An ultrasonic flow meter equipped with three detectors of staggered spatial arrangement was calibrated on a test stand with an integrating water flow meter and moreover tested when placed, the conditions being such as to correspond to the flow meter when finally placed into the primary coolant circuit of the FMRB reactor at the projected site. In the measured section undisturbed by fixtures, pumps and bends measuring errors were found to be smaller than 0.5 per cent of the final value of the measuring range. In areas with restricted flow the mean value of the three measuring signals even keeps within the narrower error margin of 0.5 per cent of the actual value.

46479 **(RKS—83-11) Experience in plant transients. The Swedish RKS program.** Bento, J.P. (Nuclear Safety Board of Swedish Utilities, Stockholm). Sep 1983. 10p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85702184.

A data-base for reactor operation experience is presented. The input comes from utilities in 14 countries. From experience with the Swedish reactors, trends have been extracted. Using the number of operational scrams as a measure of reactor management, there seem to be a maximum at early reactor life, followed by a decreasing trend after 2 years. This seems to be true for all reactors in the programme. There is even a decrease in the number of scrams with further reactor generations. Causes for events and for scrams are evaluated.

46480 **(RKS—84-02) Comparison of the course of events at the nuclear power plants on grid disturbance 1983-12-27.** (Nuclear Safety Board of Swedish Utilities, Stockholm). Jan 1984. 38p. (In Swedish). NTIS (US Sales Only), PC A03/MF A01. File Number DE85702185.

At the time of the disturbance which caused the 1983-12-27 blackout in southern Sweden, the area was a net importer of electricity. A fault cut out 2 out of 6 lines feeding the area, and most of the grid tripped. At the time 8 nuclear power units were producing into the grid which tripped. 7 of the 8 units scrammed. One unit could keep a 45% level of production, and restore full power within one hour. The other 7 units were back in production only after 12 hours or more. The report gives case histories for all units, and goes on to discuss construction parameters relevant to the faults. The capacity for steam dumping when a power grid is tripped is discussed. The dumping capacities and experiences for the utilities of other countries are related.

46481 **(SKI-B—36-81) Analysis of control room computers at nuclear power plants. Final report 1984-03-01.** Leijonhufvud, S.; Lindholm, L. (Swedish Nuclear Power Inspectorate, Stockholm). Mar 1984. 297p. (In Swedish). NTIS (US Sales Only), PC A13/MF A01. File Number DE85702186.

The following problems are analyzed: - the developing of a system - hardware and software - data - the aquisition of the system - operation and service. The findings are: - most reliability problems can be solved by doubling critical units - reliability in software has a quality that can only be created through development - reliability in computer systems in extremely unusual situations can not be quantified or verified, except possibly for very small and functionally simple systems - to attain the highest possible reliability by such simple systems these have to: - contain one or very few functions - be functionally simple - be application-transparent, viz. the internal function of the system should be independent of the status of the process - a computer system will compete succesfully with other possible systems regarding reliability for the following reasons: - if the function is simple enough for other systems, the dator system would be small - if the functions cannot be realized by other systems - the computer system would complement the human effort - and the man-machine system would be a better solution than no system, possibly better than human function only.

46482 **(UCID—18972) Human factors engineering control room design review/audit report: Grand Gulf Nuclear Station Unit 1, Mississippi Power and Light Company.** Smith, J.P. (Lawrence Livermore National Lab., CA (USA)). 30 Jun 1981. Contract W-7405-ENG-48. 47p. NTIS, PC A03/MF A01 - GPO. File Number TI85016709.

A human factors engineering preliminary design review of the Grand Gulf Unit 1 control room was performed at the site on June 8 through June 12, 1981. Observed human factor design discrepancies were given a priority rating of one to three (high, moderate, low), based on the increased potential for operator error and the possible consequences of that error. Priority rating 1 and 2 discrepancies should be corrected prior to issuance of an operating license. Priority rating 3 discrepancies should be evaluated and proposed actions reported as part of the long term design review (due one year from the issue date of NUREG-0700). A list of human factors strengths observed in the Grand Gulf Unit 1 control room is given at the end of the ten major sections of this report. This list includes those features that the review team felt enhanced the operator interface with the control room. Finally, a list of those items that could not be evaluated is presented.

## 2205 Environmental Aspects

*REFER ALSO TO CITATION(S) 46558, 47294, 47295, 47300*

46483 **(EGG-PBS—6887) Radiological Effluent Technical Specifications (RETS) implementation: Zion Generating Station Units 1 and 2.** Serrano, W.; Akers, D.W.; Duce, S.W.; Mandler, J.W.; Simpson, F.B.; Young, T.E. (EG and G Idaho, Inc., Idaho Falls (USA)). Jun 1985. Contract AC07-76ID01570. 30p. NTIS, PC A03/MF A01 - GPO. File Number TI85017485.

A review of the Radiological Effluent Technical Specifications (RETS) of the Zion Generating Station Units 1 and 2 was performed. The principal review guidelines used were NUREG-0133, "Preparation of Radiological Effluent Technical Specifications for Nuclear Power Plants," and Draft 7 of NUREG-0472, Revision 3, "Radiological Effluent Technical Specifications for Pressurized Water Reactors." Draft submittals were discussed with the Licensee by both EG and G and the NRC staff until all items requiring changes to the Technical Specifications were resolved. The Licensee then submitted final proposed RETS to the NRC which were evaluated and found to be in compliance with the NRC review guidelines. The proposed Offsite Dose Calculation Manual was reviewed and generally found to be consistent with the NRC review guidelines. 35 refs., 2 figs., 1 tab.

46484 **(EGG-PBS—6928) Technical evaluation of RETS-required reports for the La Crosse boiling water reactor.** Magleby, E.H.; Young, T.E. (EG and G Idaho, Inc., Idaho Falls (USA)). 11 Jun 1985. Contract AC07-76ID01570. 49p. NTIS, PC A03/MF A01 - GPO. File Number TI85017470.

A review of the reports required by federal regulations and the plant-specific Radiological Effluent Technical Specifications (RETS) for operations conducted during 1983 was performed. The periodic reports reviewed were the Annual Radiological Environmental Operating Report for 1983 and the Semiannual Radioactive Effluent Release Reports for 1983. The principal review guidelines were the plant-specific RETS, NUREG-0133, "Preparation of Radiological Effluent Technical Specifications for Nuclear Power Plants", and NRC Guidance on the Review of the Process Control Programs. The Licensee's submitted reports were found to be reasonably complete and consistent with the review guidelines. 5 refs.

46485 **(EGG-PBS—6931) Technical evaluation of RETS-required reports for Fort St. Vrain Nuclear Generating Station.** Young, T.E.; Magleby, E.H. (EG and G Idaho, Inc., Idaho Falls (USA)). 14 Jun 1985. Contract AC07-76ID01570. 61p. NTIS, PC A04 - GPO. File Number DE85017461.

A review of the reports required by federal regulations and the plant-specific Radiological Effluent Technical Specifications (RETS) for operations conducted during 1983 was performed. The periodic reports reviewed were the Annual Radiological Environmental Operating Report for 1983 and the Semiannual Radioactive Effluent Release Reports for 1983. The principal review guidelines were the plant's specific RETS, NUREG-0133, "Preparation of Radiological Effluent Technical Specifications for Nuclear Power Plants", and NRC Guidance on the Review of the Process Control Programs. The Licensee's submitted reports were found to be reasonably complete and consistent with the review guidelines. 6 refs.

46486 **(EGG-PBS—6935) Technical evaluation of RETS-required reports for the Edwin I. Hatch Nuclear Plant, Units 1 and 2.** Young, T.E.; Magleby, E.H. (EG and G Idaho, Inc., Idaho Falls (USA)). 21 Jun 1985. Contract AC07-76ID01570. 60p. NTIS, PC A04/MF A01 - GPO. File Number TI85017460.

A review of the reports required by federal regulations and the plant-specific Radiological Effluent Technical Specifications (RETS) for operations conducted during 1983 was performed. The periodic reports reviewed for the Edwin I. Hatch Nuclear Plant were the Annual Radiological Environmental Operating Report for 1983 and the Semiannual Radioactive Effluent Release Reports for 1983. The principal review guidelines were the plant's specific RETS, NUREG-0133, "Preparation of Radiological Effluent Technical Specifications for Nuclear Power Plants", and NRC Guidance on the Review of the Process Control Programs. The Licensee's submitted reports were found to be reasonably complete and consistent with the review guidelines. 7 refs.

46487 **(EGG-PBS—6966) Technical evaluation of RETS-required reports for La Salle County Station, Unit 1 for 1983.** Young, T.E.; Magleby, E.H. (EG and G Idaho, Inc., Idaho Falls (USA)). 15 Jul 1985. Contract AC07-76ID01570. 61p. NTIS, PC A04/MF A01 - GPO. File Number TI85017496.

A review of the reports required by federal regulations and the plant-specific Radiological Effluent Technical Specifications (RETS) for operations conducted during 1983 was performed. The periodic report reviewed for the La Salle County Station, Unit 1 was the Radioactive Waste and Environmental Monitoring Report for 1983. The principal review guidelines were the plant's specific RETS and NRC guidance given in NUREG-0133, "Preparation of Radiological Effluent Technical Specifications for Nuclear Power Plants." The Licensee's submitted reports were found to be reasonably complete and consistent with the review guidelines. 5 refs., 5 tabs.

46488 **(CE-Trans—7559) Process for the removal of radioactive corrosion products from the inner surfaces of a nuclear reactor.** Holzer, H. (Central Electricity Generating Board, London (UK)). 13 Aug 1985. C;German patent 2,617,676, April 23, 1976. 9p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85902120.

A solution is added to the coolant which has a higher oxygen concentration than water and causes the dissolution of the corrosion products in the coolant; moreover that the coolant pressure is reduced to atmospheric pressure, and the coolant containing the corrosion products is passed through a demineraliser for the removal of the products, with the coolant decontaminated in this manner being returned to the reactor cooling circuit. The oxygen solution mentioned contains essentially hydrogen peroxide. The hydrogen peroxide is introduced as a solution in water at a rate of about 0.5 l/min into a reactor coolant flow of about 100 l/min, and the coolant is circulated until a concentration of about 300 ppM is achieved at the point of introduction, and subsequently the rate of introduction is reduced and controlled in such a manner a residual concentration of 2 ppM of hydrogen peroxide is produced throughout the coolant circulating in the reactor. The pressure of the coolant is reduced to about 28 kp/cm$^2$ and its temperature to about 60°C before the oxygen-containing solution is added to the coolant.

46489 **Contamination of surface-water bodies after reactor accidents by the erosion of atmospherically deposited radionuclides.** Helton, J.C.; Muller, A.B.; Bayer, A. (Arizona State Univ., Tempe). *Health Physics;* **48**: No. 6, 757-771(Jun 1985).

Reactor safety analyses usually do not consider the population risk which might result from the contamination of surface-water bodies after reactor accidents by the erosion of atmospherically deposited radionuclides. This paper is intended to provide perspective on the reasonableness of this omission. Data are presented which are suggestive of the rates at which atmospherically deposited radionuclides might erode into surface-water bodies. These rates are used in the calculation of potential health effects resulting from surface-water contamination due to such erosion. These health effects are compared with predicted health effects due to atmospheric and terrestrial pathways after reactor accidents. The presented results support the belief that the contamination of surface-water bodies after reactor accidents by the erosion of atmospherically deposited radionuclides is not a major contributor to the risk associated with such accidents.

## 2206 Research, Test, And Experimental Reactors

*REFER ALSO TO CITATION(S) 46425, 46432, 46475, 46478, 46535, 46561*

46490 **(EGG/LTR—17-55) LOFT fuel requalification Grapple Assembly stress analysis.** Finicle, D.P. (EG and G Idaho, Inc., Idaho Falls (USA)). 29 Jun 1977. Contract AC07-76ID01570. 10p. NTIS, PC A02. File Number DE85015852.

This document is a stress analysis of the LOFT Fuel Requalification Grapple Assembly. The Grapple Assembly was analyzed using a design load of 4000 lbs, which is the capacity of the hoist. The acceptance criteria was the RDT Standard, RDT F8-6T, Reference 2. The entire Grapple Assembly met all of the stress requirements of the RDT Standard, Reference 2.

46491 **(GKSS—85/E/8) Coupled diffusion-transport computational method and its application for the determination of space dependent angular flux distributions at a cold neutron source.** Turgut, M.H. (GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.); Hamburg Univ. (Germany, F.R.). Fachbereich Physik). 1985. 128p. B. File Number DE85752246.

A fast calculation program BRIDGE was developed for the calculation of a Cold Neutron Source (CNS) at a radial beam tube of the FRG-I reactor, which couples a total assembly diffusion calculation to a transport calculation for a certain subregion. For the coupling flux and current boundary values at the common surfaces are taken from the diffusion calculation and are used as driving conditions in the transport calculation. Equivalence Theorie is used for the transport feedback effect on the diffusion calculation to improve the consistency of the boundary values. The optimization of a CNS for maximizing the subthermal flux in the wavelength range 4 - 6 A is discussed.

46492 (INIS-mf—9652, pp 27) **European high-flux neutron sources.** Rauch, H. (Atominstitut der Oesterreichischen Universitaeten, Vienna). 1984. (In German). NTIS (US Sales Only), PC A07/MF A01. File Number DE85781476. (CONF-8409235—Summ.).

From Annual meeting of the Austrian Physical Society; Leoben, Austria (24 Sep 1984).

Published in summary form only.

46493 **(JAERI-M—84-046) Annual progress report on the NSRR experiments, (14). January 1982 through December 1982.** Saito, Shinzo; Ishii, Toshio; Hoshi, Tatsuo. (Japan Atomic Energy Research Inst., Tokyo). Mar 1984. 187p. (In Japanese). NTIS (US Sales Only), PC A09/MF A01. File Number DE85702190.

Fuel behavior studies in simulated reactivity initiated accident (RIA) conditions have been performed by utilizing Nuclear Safety Research Reactor (NSRR) since October, 1975. This report describes the results obtained from January through December, 1982. A total of 52 tests were carried out during this period; those are 2 standard fuel rod tests (2 high energy deposition tests), 13 fuel design parameter tests (8 pre-pressurized fuel rod tests and 5 cladding parameter tests), 5 cooling condition parameter tests (1 coolant temperature parameter test and 4 forced convection tests), 5 defected fuel rod tests (5 fretting corroded fuel rod tests), 3 severe fuel damage tests, 10 special fuel rod tests (10 mixed oxide fuel rod tests), 3 high temperature/high pressure capsule tests, 3 high temperature/high pressure loop tests, 3 fuel behavior observation tests, and 5 miscellaneous tests.

46494 **(JAERI-M—84-066) Development of heat transfer package for JRR-3 thermohydrodynamic analysis.** Sudo, Yukio; Ikawa, Hiromasa; Hirano, Masashi; Ohnishi, Nobuaki. (Japan Atomic Energy Research Inst., Tokyo). Mar 1984. 80p. (In Japanese). NTIS (US Sales Only), PC A05/MF A01. File Number DE85702206.

This report presents a package of heat transfer correlations which were developed for the thermohydrodynamic analysis of the research reactor, JRR-3 at the Japan Atomic Energy Research Institute (JAERI). The applicability and validity of the heat transfer correlations were investigated through the comparison with available existing experiments under the elaborate considerations for key features of the JRR-3. The JRR-3 is a research reactor of about 20 MWt at a normal condition, whose core is cooled by the downflow at about 6 m/s under rather low pressure and temperature. The heat transfer package presented in this report are applicable for both downflow and upflow in a narrow rectangular subchannel at the normal operation, operational transients and accidents in the thermohydrodynamic analysis of the JRR-3.

46495 **(JAERI-M—84-079) Design basis of thermohydrodynamics for JRR-3.** Sudo, Yukio; Ando, Hiroei; Ikawa, Hiromasa; Shinozu, Kazuo; Ohnishi, Nobuaki. (Japan Atomic Energy Research Inst., Tokyo). May 1984. 145p. (In Japanese). NTIS (US Sales Only), PC A07/MF A01. File Number DE85702172.

This report describes the design basis of thermohydrodynamics for the 20 MWt research reactor, JRR-3, which is to be constructed at the Japan Atomic Energy Research Institute (JAERI), based on the investigation of the thermohydrodynamic characteristics for the JRR-3. Thermohydrodynamic characteristics at the condition of normal operation were investigated to confirm that the JRR-3 design satisfies the design criteria for the normal operation condition. Besides, key items were also investigated which are necessary to evaluate the safety margin of the JRR-3 design for the operational transients and accidents.

46496 **(JAERI-M—84-086) Doppler effect measurement in FCA assemblies X-3 and XI-1.** Okajima, Shigeaki; Mukaiyama, Takehiko. (Japan Atomic Energy Research Inst., Tokyo). May 1984. 32p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. File Number DE85702173.

Doppler reactivity worths were measured in FCA assemblies X-3 (mock-up core for JOYO Mark II) and XI-1 (mock-up core for large scale LMFBR) for U-238 and structural materials of core (iron, stainless steel and nickel). The sample oscillation technique was used to measure the Doppler effect when a sample is heated up to 800°C from room temperature. The analysis was made using the 70 group JFS-3-J2 data set, and compared with the measured results. For U-238 samples, the calculation underestimates Doppler effects by 10%, on the other hand for other samples, the agreement between calculated values and measured values is quite good.

46497 **(JAERI-M—84-099) Neutronics design of upgraded JRR-3 research reactor.** Tsuruta, Harumichi; Ichikawa, Hiroki; Iwasaki, Junichi. (Japan Atomic Energy Research Inst., Tokyo). May 1984. 140p. (In Japanese). NTIS (US Sales Only), PC A07/MF A01. File Number DE85702174.

The research reactor JRR-3 is currently planned to be upgraded by replacing the core and related cooling system. The proposed reactor is a water-moderated and -cooled pool type of 20 MW thermal output. The neutronics calculation was carried out on the core using 20% enriched U.Alsub(x) fuel. The results show that the core performances, such as reactivity, neutron flux, and burnup, are sufficient for beam experiments, material testing, and isotope production.

46498 **(KAERC—2/84) Reconstruction of experimental research reactor.** Kim Do Sul. (State Committee for Atomic Energy, Pyongyang (D.P.R. of Korea). Research Center for Atomic Energy.). Aug 1984. 9p. (In Korean). NTIS (US Sales Only), PC A02/MF A01. File Number DE85702207.

In the paper were reviewed the results obtained by the reactor power which had been increased to 4000 KW by reconstructing core and first cooling system, and the use of new type fuel assemblies with higher enrichment and greater heat exchange surface.

## 2207 Plutonium And Isotope Production Reactors

46499 (INIS-SU—301, pp 80-84) **System model for integral experiments on radionuclide production.** Shimanskaya, N.S.; Gerasimenko, B.F.; Dushin, V.N.; Ippolitov, V.T.; Korolev, E.V.; Matveev, G.V.; Yavshits, S.G. (Radievyj Inst., Leningrad (USSR)). 1984. (In Russian). NTIS (US Sales Only), PC A18/MF A01. File Number DE85781590. (CONF-8310228—).

From 6. Soviet national conference on neutron physics; Kiev, USSR (10 Oct 1983).

The TRIZOT program package (FORTRAN, ES computer) plotted on the basis of system-model approach and intended for comparative analysis of nuclear-physical facilities for production of radionuclides with qualitatively different neutron spectra is described in brief. Functionally the program package is divided into 3 parts; preparation of nuclear data, solution of transmutation equations and determination of coefficients of sensitivity to parameters of calculation.

## 2209 Reactor Safety

*REFER ALSO TO CITATION(S) 46081, 46489, 46720, 47233, 47294, 47295, 47387, 47856*

46500 **(BNL-NUREG—36799) Systems interaction study of a Westinghouse PWR.** Youngblood, R.; Hanan, N.; Fitzpatrick, R.; Xue, D.; Bozoki, G.; Fresco, A.; Papazoglou, I.A. (Brookhaven National Lab., Upton, NY (USA)). 1985. Contract AC02-76CH00016. 5p. (CONF-850713—). NTIS, PC A02/MF A01 - GPO. File Number TI85017519.

From International conference on nuclear power plant aging, availability factor and reliability analysis; San Diego, CA, USA (7 Jul 1985).

This paper presents methods and findings of a systems interaction study of Indian Point 3. The study was carried out in support of the resolution of Unresolved Safety Issue A-17 on Systems Interactions. Fault tree methods were employed. Among the study's findings is a single active failure in the low pressure injection function; this discovery led to a plant modification. In addition to providing support to the staff in resolving USI A-17, the project discovered an important new class of failure modes which led the utility to implement a hardware modification. The scope of the project is indicated, key features of the method are highlighted findings are discussed, and comments are offered on the usefulness of this type of, principal study. 9 refs., 1 fig., 1 tab.

46501 **(CONF-850610—36) Methodology for estimating sodium aerosol concentrations during breeder reactor fires.** Fields, D.E.; Miller, C.W. (Oak Ridge National Lab., TN (USA)). 1985. Contract AC05-84OR21400. 8p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016414.

From Annual meeting of the American Nuclear Society; Boston, MA, USA (9 Jun 1985).

We have devised and applied a methodology for estimating the concentration of aerosols released at building surfaces and monitored at other building surface points. We have used this methodology to make calculations that suggest, for one air-cooled breeder reactor design, cooling will not be compromised by severe liquid-metal fires.

46502 **(CONF-850903—9) MAPPS (Maintenance Personnel Performance Simulation): a computer simulation model for human reliability analysis.** Knee, H.E.; Haas, P.M. (Oak Ridge National Lab., TN (USA)). 1985. Contract AC05-84OR21400. 9p. NTIS, PC A02/MF A01 - GPO. File Number TI85017078.

From International topical meeting on computer applications for nuclear power plant operation and control; Pasco, WA, USA (8 Sep 1985).

A computer model has been developed, sensitivity tested, and evaluated capable of generating reliable estimates of human performance measures in the nuclear power plant (NPP) maintenance context. The model, entitled MAPPS (Maintenance Personnel Performance Simulation), is of the simulation type and is task-oriented. It addresses a number of person-machine, person-environment, and person-person variables and is capable of providing the user with a rich spectrum of important performance measures including mean time for successful task performance by a maintenance team and maintenance team probability of task success. These two measures are particularly important for input to probabilistic risk assessment (PRA) studies which were the primary impetus for the development of MAPPS. The simulation nature of the model along with its generous input parameters and output variables allows its usefulness to extend beyond its input to PRA.

46503 **(CONF-850996—3) Human factors review for nuclear power plant severe accident sequence analysis.** Krois, P.A.; Haas, P.M. (Oak Ridge National Lab., TN (USA)). 1985. Contract AC05-84OR21400. 17p. NTIS, PC A02/MF A01 - GPO. File Number TI85017081.

From 29. Human Factors Society annual meeting; Baltimore, MD, USA (30 Sep 1985).

The paper discusses work conducted to: (1) support the severe accident sequence analysis of a nuclear power plant transient

based on an assessment of operator actions, and (2) develop a descriptive model of operator severe accident management. Operator actions during the transient are assessed using qualitative and quantitative methods. A function-oriented accident management model provides a structure for developing technical operator guidance on mitigating core damage preventing radiological release.

46504 **(CONF-8508106—1) Current practice and developmental efforts for leak detection in US reactor primary systems.** Kupperman, D.S.; Claytor, T.N. (Argonne National Lab., IL (USA)). Jul 1985. Contract W-31-109-ENG-38. 9p. NTIS, PC A02/MF A01 - GPO. File Number TI85016606.

From CSNI specialist meeting on continuous monitoring techniques for assuring coolant circuit integrity; London, England (12 Aug 1985).

Current leak detection practices in 74 operating nuclear reactors have been reviewed. Existing leak detection systems are adequate to ensure a leak-before-break scenario in most situations, but no currently available, single method combines optimal leakage detection sensitivity, leak-locating ability, and leakage measurement accuracy. Simply tightening current leakage limits may produce an unacceptably large number of unnecessary shutdowns. The use of commercially available acoustic monitoring systems or moisture-sensitive tape may improve leak detection capability at specific sites. However, neither of these methods currently provides source discrimination (e.g., to distinguish between leaks from pipe cracks and valves) or leak-rate information (a small leak may saturate the system). A field-implementable acoustic leak detection system is being developed to address these limitations. 5 refs., 3 figs.

46505 **(EGG/CDAP-TR—78-034) LPWR "EM" models for RELAP4/MOD5. Code Development and Analysis Program.** Johnsen, G.W.; Sullivan, L.H. (Idaho National Engineering Lab., Idaho Falls (USA)). Aug 1978. Contract AC07-76ID01570. 75p. NTIS, PC A04 - GPO. File Number DE85016688.

This report presents several RELAP4 models and modeling techniques used to conservatively predict LPWR hydraulic behavior during a loss-of-coolant accident. These models were developed for use in conjunction with the RELAP4/MOD5 and RELAP4/MOD6 computer programs. Included in this report are descriptions of the models and techniques, methods of implementation, and where applicable, sample results. 7 refs., 16 figs.

46506 **(EGG-EA—6948) Safety Evaluation Report, Pump and Valve Inservice Testing Program, D.C. Cook Nuclear Power Station, Units 1 and 2.** Cook, T.L.; Rockhold, H.C. (EG and G Idaho, Inc., Idaho Falls (USA)). Jul 1985. Contract AC07-76ID01570. 91p. NTIS, PC A05/MF A01 - GPO. File Number TI85017499.

A safety evaluation of the pump and valve inservice testing (IST) program submitted by the Indiana and Michigan Electric Company for their D.C. Cook Nuclear Power Station, Units 1 and 2. The conclusions in this SER of the D.C. Cook Nuclear Power Station, Units 1 and 2 pump and valve inservice testing program and the associated relief requests are those of the NRC staff. These findings apply only to component testing (i.e., pumps and valves), and are not intended to provide the basis to change the licensee's current technical specifications system test requirements, such as those for the Auxiliary Feedwater System.

46507 **(EGG/LTR—20-80) FRAP-T2 fuel behavior calculation of LOFT unpressurized and pressurized fuel during loss-of-coolant experiments.** Takeshita, I.; Solbrig, C.W. (EG and G Idaho, Inc., Idaho Falls (USA)). 6 Jun 1978. Contract AC07-76ID01570. 51p. NTIS, PC A04. File Number DE85015872.

This is an analysis of pressurized fuel behavior under loss-of-coolant accident conditions. The analysis was performed to provide reference information for future selection of prepressurization levels for pressurized fuel pins in the Loss-of-Fluid Test (LOFT) facility. The center fuel module to be installed in the LOFT nuclear core for the fifth experiment (designated L2-5) in the first series of five nuclear loss-of-coolant experiments will contain pressurized fuel pins. Three pressurization levels (unpressurized and pressurized at 351 psi and 723 psi) were calculated for the blowdown phase of Experiment L2-5 with a peak linear heat rate of 16 kW/ft. These three pressurization levels were selected to determine how the maximum cladding temperature varies with fuel prepressurization level and fuel burnup. The calculations were performed using the RELAP4/MOD5 and FRAP-T2 computer codes. The results show that the maximum peak clad temperature decreases as the prepressurization level increases. This conclusion, however, is based on using two different models for gap conductance: one for pressurized fuel and one for unpressurized fuel. This study should be conducted again when a consistent gap conductance model that can model both pressurized and unpressurized fuel is available.

46508 **(EGG/LTR—1113-2) Core differential pressure during nonnuclear LOCE.** Dugone, J. (Aerojet Nuclear Co., Idaho Falls, ID (USA)). 26 Jul 1972. Contract AC07-76ID01570. 27p. NTIS, PC A03/MF A01 - GPO. File Number TI85016691.

A study was made to assess the capability of the LOFT system to perform nonnuclear blowdown tests with the core in place to support the Experimental Requirements Document (ERD) recommendation that such tests be performed. Results of this study show that the maximum core differential pressure during a LOCE equivalent to a 4-loop LPWR is 109 psid. Also, the peak dynamic load per support tube during the most severe nuclear LOCE is 525 pounds compared to an allowable of 830 pounds. Thus, it is concluded that the LOFT system has the compability to perform nonnuclear blowdown tests with the core in place.

46509 **(EGG-M—03985) Return to nucleate boiling.** Shumway, R.W. (EG and G Idaho, Inc., Idaho Falls (USA)). 1985. Contract AC07-76ID01570. 52p. (CONF-850810—12). NTIS MF A01. File Number TI85008003.

From National heat transfer conference; Denver, CO, USA (4 Aug 1985).

This paper presents a collection of TMIN (temperature of return to nucleate boiling) correlations, evaluates them under several conditions, and compares them with a wide range of data. Purpose is to obtain the best one for use in a water reactor safety computer simulator known as TRAC-B. Return to nucleate boiling can occur in a reactor accident at either high or low pressure and flow rates. Most of the correlations yield unrealistic results under some conditions. A new correlation is proposed which overcomes many of the deficiencies.

46510 **(EGG-RE-E—77-140) PWR fuel assembly mechanical response analysis, Amendment No. 1.** Grubb, R.L. (EG and G Idaho, Inc., Idaho Falls (USA)). 22 Mar 1977. Contract AC07-76ID01570. 20p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85013341.

The analysis presented herein is a continuation of the LOCA fuel assembly dynamic analysis for the North Anna PWR Unit 1. Initial results are documented in EGG-RE-E-77-141. Results of this continuation support the conclusions of the original report although for different reasons. In particular, these results were used in conjunction with available data to conclude that the North Anna Plant fuel assemblies are structurally acceptable under present code requirements.

46511 **(EGG-RST—6984) Feasibility study of technologies to aid in the diagnosis of nuclear plant transients.** Bertch, W.J.; Bray, M.A.; Esparza, V.; Fink, R.K.; Shepherd, J.C.; Venhuizen, J.R. (EG and G Idaho, Inc., Idaho Falls (USA)). Aug 1985. Contract AC07-76ID01570. 56p. NTIS, PC A04/MF A01 - GPO. File Number TI85017468.

A technical feasibility study was performed to identify and evaluate the various computerized techniques available to diagnose and identify nuclear power plant transients in support of improving operator response to emergencies. Five categories of methods were investigated: expert system technology, computerized alarm handling, data driven displays, estimation and failure detection, and fault tree/event tree techniques. Literature searches and personal contacts were used to obtain information on specific methods and their applications within these categories. A set of evaluation criteria was established and an Analytic Hierarchy Process evaluation of the methods was performed. An integrated approach for a comput-

erized operator aid, combining the strong features from the various methods, appears to be the most promising. 91 refs., 1 tab.

46512 **(EGG-SEMI—6919) Pretest analysis document for Test S-FS-7.** Hall, D.G. (EG and G Idaho, Inc., Idaho Falls (USA)). Jun 1985. Contract AC07-76ID01570. 49p. NTIS, PC A03/MF A01 - GPO. File Number TI85017486.

This report documents the pretest calculations completed for Semiscale Test S-FS-7. This test will simulate a transient initiated by a 14.3% break in a steam generator bottom feedwater line downstream of the check valve. The initial conditions represent normal operating conditions for a C-E System 80 nuclear power plant. Predictions of transients resulting from feedwater line breaks in these plants have indicated that significant primary system overpressurization may occur. The results of a RELAP5/MOD2/CY21 code calculation indicate that the test objectives for Test S-FS-7 can be achieved. The primary system overpressurization will occur but pose no threat to personnel or to plant integrity. 3 refs., 15 figs., 5 tabs.

46513 **(EGG-SEMI—6985) Pretest analysis document for Test S-FS-11.** Hall, D.G.; Shaw, R.A. (EG and G Idaho, Inc., Idaho Falls (USA)). Jul 1985. Contract AC07-76ID01570. 48p. NTIS, PC A03/MF A01 - GPO. File Number TI85017495.

This report documents the pretest calculations completed for Semiscale Test S-FS-11. This test will simulate a transient initiated by a 50% break in a steam generator bottom feedwater line downstream of the check valve. The initial conditions represents normal operating conditions for a C-E System 80 nuclear plant. Prediction of transients resulting from feedwater line breaks in these plants have indicated that significant primary system overpressurization may occur. The results of a RELAP5/MOD2/CY21 code calculation indicate that the test objectives for Test S-FS-11 can be achieved. The primary system overpressurization will occur but pose no threat to personnel or plant integrity. 3 refs., 15 figs., 5 tabs.

46514 **(EGG-TMI—6894) Tellurium chemistry, tellurium release and deposition during the TMI-2 accident.** Vinjamuri, K.; Sallach, R.A.; Osetek, D.J.; Hobbins, R.R.; Akers, D.W. (EG and G Idaho, Inc., Idaho Falls (USA)). Aug 1985. Contract AC07-76ID01570. 70p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85017500.

This report presents the chemistry and estimated behavior of tellurium during and after the accident at Three Mile Island Unit-2. The discussion of tellurium behavior is based on all available measurement data for /sup 129 m/Te, $^{132}$Te, stable tellurium ($^{128}$Te, $^{126}$Te, and $^{130}$Te), and best estimate calculations of tellurium release and transport. Results from Oak Ridge National Laboratory (ORNL) tests, Power Burst Facility (PBF) Severe Fuel Damage Tests at Idaho National Engineering Laboratory (INEL) and SASCHA tests from Karlsruhe, W. Germany are compared with calculated release fractions and samples taken from TMI Unit-2. It is concluded that very little tellurium was released and transported from the TMI-2 core, probably as a result of holdup by zircaloy cladding and other structural materials. 39 refs., 24 figs., 17 tabs.

46515 **(GRS-F—143) List of reports of BMFT, CEA, EPRI, JSTA and USNRC in the field of reactor safety research.** (Gesellschaft fuer Reaktorsicherheit m.b.H. (GRS), Koeln (Germany, F.R.)). Apr 1985. 71p. (In German). NTIS (US Sales Only), PC A04/MF A01. File Number DE85752338.

This list reviews reports from the Federal Republic of Germany, from France, from Japan and from the United States of America concerning special problems in the field of Reactor Safety Research. According to the cooperation of the Bundesminister fuer Forschung und Technologie (BMFT) with the Commisariat a l'Energie Atomique (CEA), the Japan Science and Technology Agency (JSTA), the Electrical Power Research Institute (EPRI) and the United States Nuclear Regulatory Commision, these reports are available in the Gesellschaft fuer Reaktorsicherheit (GRS). The list pursues the following order: Country of origin, problem area concerned, according to the Reactor Safety Research Programm of the BMFT, reporting organization. The list of reports appears quaterly.

46516 **(INFO—0068-Rev.1) Emergency core cooling systems in CANDU nuclear power plants.** (Atomic Energy Control Board, Ottawa, Ontario (Canada). Advisory Committee on Nuclear Safety). Dec 1981. 53p. (In English and French). NTIS (US Sales Only), PC A04/MF A01. File Number DE85702204.

This report contains the responses by the Advisory Committee on Nuclear Safety (ACNS) to three questions posed by the Atomic Energy Control Board (AECB) concerning the need for Emergency Core Cooling Systems (ECCS) in CANDU nuclear power plants, the effectiveness requirement for such systems, and the extent to which experimental evidence should be available to demonstrate compliance with effectiveness standards. The report includes a review of the background of the present requirements for ECCS and the Committee's rationale that led to the responses provided.

46517 (INIS-mf—9652, pp 86) **RELAP 4/MOD 6: a computer code for thermohydraulic calculation of coolant loss accidents in nuclear power plants.** Sonneck, G.; Pfau, H. (Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H. Inst. fuer Reaktorsicherheit). 1984. (In German). NTIS (US Sales Only), PC A07/MF A01. File Number DE85781476. (CONF-8409235—Summ.).

From Annual meeting of the Austrian Physical Society; Leoben, Austria (24 Sep 1984).

Published in summary form only.

46518 (INIS-mf—9711, pp 18-30) **4. Computer assessment of seismic resistance of technological equipment.** 1983. (In Czech). NTIS (US Sales Only), PC A05/MF A01. File Number DE85781556.

In Seismic effects on technological equipment and systems of nuclear power plants.

The mathematical model of seismic resistance are given. The computer method is selected by the characteristic of the mathematical model. Accelerograms, i.e., response spectra, are used as input data. Values of coefficients of internal damping are tabulated for different types of constructions. A survey is given of programmes suited for investigating the dynamic responses of constructions, equipment and systems of nuclear power plants available in Czechoslovakia. The method of evaluating the results of the analysis is discussed. (E.F.).

46519 (INIS-mf—9711, pp 59-65) **6. Experimental assessment of seismic resistance of technological equipment.** 1983. (In Czech). NTIS (US Sales Only), PC A05/MF A01. File Number DE85781556.

In Seismic effects on technological equipment and systems of nuclear power plants.

Procedures are described used for testing seismic resistance as are types of tests and methods of simulating seismic excitation. The seismic resistance of electric equipment is tested on a vibrostand or a vibration table with hydraulic cylinders simulating seismic excitation inputted using accelerograms or response spectra at points of anchorino. Testing is performed within the frequency range of 0.5 to 50 Hz. Testing and operating anchorage must be identical. Seismic resistance of the electric equipment of the Mochovce nuclear power plant will have to be determined by computation and tests of small electrical devices - this is because large seismic stands are not available in Czechoslovakia. (E.F.).

46520 (INIS-mf—9711, pp 66-87) **7. Selected problems of nuclear and conventional power engineering.** 1983. (In Czech). NTIS (US Sales Only), PC A05/MF A01. File Number DE85781556.

In Seismic effects on technological equipment and systems of nuclear power plants.

The mathematical solution is performed of the dynamic response of continuum to seismic excitation, with application to forced rod oscillations. The seismic response is computed of tanks containing liquid and the response of the vertical cylindrical tanks containing liquid to seismic excitation in the base. Seismic effects are computed on piping system. The example is given of the dynamic computer model of one loop of the primary circuit of the

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Mochovce nuclear power plant. Dynamic models are given of a WWER reactor and a turboset with base. (E.F.).

46521 (INIS-mf—9711, pp 88-104) **8. Antiseismic precautions and a survey of practical design means of limiting seismic effects on technological equipment and systems of nuclear power plants.** 1983. (In Czech). NTIS (US Sales Only), PC A05/MF A01. File Number DE85781556.

In Seismic effects on technological equipment and systems of nuclear power plants.

Aseismic isolation of buildings will be secured by a reliable protective filter in the foundation. The filter must be flexible or elastoplastic, dynamically tuned to the range of dominant frequencies of seismic excitations, i.e., below 1 Hz. Foreign experience with various filters (rubber, reinforced neopren, spring isolators plus viscous dampers) are tabulated. Conventional modifications in the design of technological equipment and nuclear power plant systems are described on the basis of data published in foreign sources. The use of additional dampers, attenuators and vibration absorbers is described, their diagrams and integration in dynamic systems given. (E.F.).

46522 (INIS-mf—9758, pp vp) **Objective and subjective perception of risk - radiation risk and calculations of usefulness.** Holmberg, P. (Helsinki Univ. (Finland). Dept. of Physical Medicine). 1984. (In Swedish). NTIS (US Sales Only), PC A08/MF A01. File Number DE85781601. (CONF-8410282—Absts.).

From 7. Nordic Society for Radiation Protection ordinary meeting; Copenhagen, Denmark (10 Oct 1984).

Published in summary form only.

46523 **(INIS-mf—9762) Report on safety related occurrences and reactor trips January 1-June 30, 1984.** (Swedish Nuclear Power Inspectorate, Stockholm). 1984. 75p. NTIS (US Sales Only), PC A04/MF A01. File Number DE85781612.

This is a systematically arranged report on all safety-related occurrences and reactor trips in Swedish nuclear power plants in operation during the period from January 1 to June 30 1984. It is based on the reports submitted by the utilities to the Swedish Nuclear Inspectorate according to Technical Specifications. Twice a year since 1974 the Inspectorate has issued a compilation on such reported occurrences and reactor trips. Starting with the compilation of the second half of 1982 some new features have been introduced. The most important change is that the volume of information has been increased. The full text, provided by the utilities when reporting the incidents, is now attached to the codified information and also the layout has been altered to facilitate reading. As in the previous reports the occurrences and reactor trips are arranged both alphabetically by facility name and chronologically by report number for each facility. Electricity generation charts for each facility are also presented. The primary purpose of this report is thus to present all the information furnished by the utilities when they submit their reports according to Technical Specifications. The only evaluation made by the Inspectorate is the categorization on the incidents. Like the previous reports this one also presents frequency of incidents as related to affected component, cause of incident etc. The difference is that only information reported by the utilities is used. This is the reason why a considerable proportion of the incidents are categorized as other component or other fault. Sometime in the future, however, the Inspectorate plants to put out a special report containing its own analyses of the most interesting events along with processed statistics and other information. (author).

46524 **(IS-M—542) 3-D analysis of a containment equipment hatch.** Greimann, L.; Fanous, F. (Ames Lab., IA (USA)). 1985. Contract W-7405-ENG-82. 12p. (CONF-8504168—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85015511.

From ANSYS conference; Pittsburgh, PA, USA (24 Apr 1985).

There are at least two models used to characterize the possible leakage of a containment during a severe accident: (1) the threshold model in which the containment is assumed to be leaktight until certain pressure/temperature conditions are reached and a very large rupture occurs; and (2) the leak-before-break model in which small leak paths are hypothesized to develop at levels below the threshold. The objective of this work is to investigate the leak-before-break potential of a typical equipment hatch seal. The relative deformations of the sealing surfaces during pressurization are of interest, especially if any buckling of the hatch occurs. A three-dimensional finite element model of the equipment hatch assembly was developed. The model included: shell elements for the containment shell, containment stiffeners, penetration sleeve and hatch shell; prestressed bar elements for the swing bolts which hold the hatch closed; and interface elements for the sliding or opening which can occur at the seal surfaces. The nonlinear material properties were approximated by a piecewise linear curve with a proportional limit equal to one-half the yield strength. Geometric nonlinearities were also included in the model. As pressure increments were added to the finite element model, the seal surfaces tended to move together initially. The dominate observable behavior in this range was "ovaling" of the penetration sleeve relative to the hatch cover. Since the hatch itself tended to remain circular, there was a mismatch at the sealing surface. Friction reduces but does not eliminate this relative motion. As the containment reached a higher pressure level, the hatch began to buckle at the idealized imperfection. The finite element solution was incremented through the snapthrough. As this postbuckling occurred, additional seal interface distortion was observed.

46525 **(JAERI-M—84-026) Evaluation report on CCTF Core-II reflood tests C2-AC1 (run 51) and C2-4 (run 62). Effect of initial clad temperature.** Sugimoto, Jun; Iguchi, Tadashi; Murao, Yoshio. (Japan Atomic Energy Research Inst., Tokyo). Feb 1984. 85p. NTIS (US Sales Only), PC A05/MF A01. File Number DE85702194.

A reflood test program has been conducted at Japan Atomic Energy Research Institute (JAERI) using large scale test facilities named Cylindrical Core Test Facility (CCTF) and Slab Core Test Facility (SCTF). The present report describes the effect of the initial clad temperature i.e., the initial stored energy on reflood phenomena observed in CCTF Core-II tests C2-ACl and C2-4. The peak clad temperatures of tests C2-ACl and C2-4 were 863 K and 1069 K, respectively at reflood initiation. With higher initial clad temperature, obtained were lower water accumulation in the core and upper plenum, and higher loop mass flow rate in an early reflood transient due to larger heat release of the stored energy in the core. Core inlet flow conditions were only affected shortly after the reflood initiation, causing the suppressed flooding rate and the larger U-tube flow oscillation between the core and the downcomer. In the core, with higher initial clad temperature, slower quench front propagation and higher turnaround temperature were observed. Responses to a higher initial clad temperature were similar to those observed in CCTF Core-I and FLECHT tests. Thus, the lower temperature rise with higher initial clad temperature was experimentally confirmed. The importance of higher flooding rate at initial period was analytically shown for further decreasing the temperature rise.

46526 **(JAERI-M—84-029) Updated core power curves for ROSA-III facility.** Iriko, Masanori; Yonomoto, Taisuke; Suzuki, Mitsuhiro; Kukita, Yutaka; Tasaka, Kanji. (Japan Atomic Energy Research Inst., Tokyo). Feb 1984. 56p. (In Japanese). NTIS (US Sales Only), PC A04/MF A01. File Number DE85702187.

New core electric power vs. time curves are developed for experiments on boiling-water-reactor (BWR) loss-of-coolant accidents (LOCAs) with the ROSA-III facility. These power curves are determined so that correct rod surface heat flux is obtained on the ROSA-III electric heater rods which represent the BWR nuclear fuel rods. The power curve formerly used in the ROSA-III experiments was determined conservatively so that the rod surface heat flux was higher than that on the BWR fuel rods. The new power curves are determined based on simplified core heat transfer calculations which account for the non-steady heat conduction within the fuel/heater rods. It is assumed that nucleate boiling is maintained on the rod surface throughout the blowdown. Two power curves are presented with which correct heat flux is ob-

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tained on the ROSA-III average-power and peak-power rods, respectively.

46527 **(JAERI-M—84-030) Study on similarity between ROSA-III and BWR/6 during a small break LOCA.** Yonomoto, Taisuke; Tasaka, Kanji. (Japan Atomic Energy Research Inst., Tokyo). Feb 1984. 168p. (In Japanese). NTIS (US Sales Only), PC A08/MF A01. File Number DE85702188.

The similarity between the ROSA-III test results and a BWR/6 transient during a small break LOCA has been studied. In order to investigate the similarity, the ROSA-III test results was analyzed first by RELAP4/MOD6/U4/J3 code and the capability and the limitation of the code were studied. Afterwards, a BWR/6 small break LOCA transient was analyzed using the same code and the same input model to study the similarity. The selected experiment for the analysis was the ROSA-III test, Run 912, which simulated a 5% split break at the pump inlet in the recirculation line with the condition of HPCS failure. The basic thermal-hydraulic phenomena such as the system pressure, core mixture levels and fuel cladding surface temperatures appeared in Run 912 were calculated accurately by the RELAP4/MOD6/U4/J3 code. The calculated results of the ROSA-III test agreed well with the analysis results of the BWR/6 transient. It has been concluded that the similarity between ROSA-III and BWR/6 during a small break LOCA is good.

46528 **(JAERI-M—84-042) Assessment of TRAC-PF1 predictive capability for the thermal hydraulic behavior along a primary loop during the reflood phase of a PWR LOCA.** Akimoto, Hajime. (Japan Atomic Energy Research Inst., Tokyo). Mar 1984. 81p. NTIS (US Sales Only), PC A05/MF A01. File Number DE85702195.

In order to identify the reason for the problems in the previous TRAC calculations for the estimation of the loop flow resistance coefficient and the heat transfer at the steam generator, and to assess the capability of the TRAC code for the prediction of the thermal hydraulic behavior along a primary loop during the reflood phase of a PWR LOCA, a parametric study was performed with TRAC-PF1 code using the data from the CCTF test C1-19(Run 38) as the initial and boundary conditions. Through the comparison between CCTF and TRAC results, it was found that the overestimation of the loop flow resistance coefficient and the underestimation of the total energy transfer were caused by the error in the input data of the additive friction factor at the pump simulator and the overestimation of the flow quality through the steam generator, respectively. A review on the following items is recommened for the future improvements of the TRAC-PF1 code: (a) Water accumulation model at the inlet plenum of the steam generator. (b) Heat transfer model at the steam generator, especially for the evaporation rate of incoming water. (c) Critical flow model in the condensing two-phase flow, especially when flowing steam is condensed completely due to the direct contact with the subcooled ECC water.

46529 **(JAERI-M—84-045) Experiment data of 200% recirculation pump discharge line break integral test run 961 with HPCS failure at ROSA-III and comparison with results of suction line break tests.** Suzuki, Mitsuhiro; Tasaka, Kanji; Nakamura, Hideo; Anoda, Yoshinari; Kumamaru, Hiroshige; Murata, Hideo; Yonomoto, Taisuke; Shiba, Masayoshi. (Japan Atomic Energy Research Inst., Tokyo). Mar 1984. 247p. NTIS (US Sales Only), PC A11/MF A01. File Number DE85702189.

This report presents the experimental data of RUN 961, a 200% double-ended break test at the recirculation pump discharge line in the ROSA-III test facility. The ROSA-III test facility is a volumetrically scaled (1/424) system of the BWR/6. The facility has the electrically heated core, the break simulator and the scaled ECCS (Emergency Core Cooling System). The MSIV (Main Steam Isolation Valve) closure and the ECCS actuation were tripped by the liquid level in the upper downcomer. The PCT (Peak Cladding Temperature) was 894 K, which was 107 K higher than a 200% pump suction line break test (RUN 926) due to the smaller depressurization rate. The effect of break location on transient LOCA phenomena was clarified by comparing the discharge and suction break tests. The whole core was quenched 71 s after LPCI actuation and the effectiveness of ECCS has been confirmed.

46530 **(JAERI-M—84-055) Analysis and research status of severe core damage accidents. Report by Severe Core Damage Accident Research and Analysis Task Force.** (Japan Atomic Energy Research Inst., Tokyo). Mar 1984. 497p. (In Japanese). NTIS (US Sales Only), PC A21/MF A01. File Number DE85702191.

The Severe Core Damage Research and Analysis Task Force was established in Nuclear Safety Research Center, Tokai Research Establishment, JAERI, in May, 1982 to make a quantitative analysis on the issues related with the severe core damage accident and also to survey the present status of the research and provide the required research subjects on the severe core damage accident. This report summarizes the results of the works performed by the Task Force during last one and half years. The main subjects investigated are as follows; (1) Discussion on the purposes and necessities of severe core damage accident research, (2) proposal of phenomenological research subjects required in Japan, (3) analysis of severe core damage accidents and identification of risk dominant accident sequences, (4) investigation of significant physical phenomena in severe core damage accidents, and (5) survey of the research status.

46531 **(JAERI-M—84-063) Study on gap heat transfer of LWR fuel rods under reactivity initiated accident conditions.** Fujishiro, Toshio. (Japan Atomic Energy Research Inst., Tokyo). Mar 1984. 182p. (In Japanese). NTIS (US Sales Only), PC A09/MF A01. File Number DE85702196.

Gap heat transfer between fuel pellet and cladding have a large influence on the LWR fuel behaviors under reactivity initiated accident (RIA) conditions. The objective of the present study is to investigate the effects of gap heat transfer on RIA fuel behaviors based on the results of the gap-gas parameter tests in NSRR and on their analysis with NSR-77 code. Through this study, transient variations of gap heat transfer, the effects of the gap heat transfer on fuel thermal behaviors and on fuel failure, effects of pellet-cladding sticking by eutectic formation, and the effects of cladding collapse under high external pressure have been clearified. The studies have also been performed on the applicability and its limit of modified Ross and Stoute equation which is extensively utilized to evaluate the gap heat transfer coefficient in the present fuel behavior codes. The method to evaluate the gap conductance to the conditions beyond the applicability limit of the Ross and Stoute equation has also been proposed.

46532 **(JAERI-M—84-065) Evaluation of advanced two-phase flow instrumentation in SCTF Core-1.** Iwamura, Takamichi; Sobajima, Makoto; Osakabe, Masahiro; Ohnuki, Akira; Abe, Yutaka; Sudo, Yukio; Adachi, Hiromichi. (Japan Atomic Energy Research Inst., Tokyo). Mar 1984. 156p. NTIS (US Sales Only), PC A08/MF A01. File Number DE85702197.

In the Slab Core Test Facility (SCTF) Core-I, advanced two-phase flow instruments have been provided by the USNRC to measure the thermohydraulic behavior in the primary system including pressure vessel during the end of blowdown, refill and reflood phases of a postulated loss-of-coolant accident in a pressurized water reactor. The advanced instruments are turbine meters, drag disks, γ-densitometers, spool pieces, liquid level detectors (LLD), fluid distribution grids (FDG), impedance probes (flag, prong and string probes), film probes, and video optical probes. This report presents evaluated results of the data from these instruments. Some instruments are quantitatively evaluated by comparing with the data from the conventional instruments or the other advanced instruments. Main conclusions are as follows: (1) The spool pieces and the γ-densitometers work well and provide satisfactory results; (2) Some of the turbine meters, the impedance probes and the film probes give partially reasonable results, but still more improvements are required; (3) Most of the LLDs, the FDGs, the impedance probes, and the film probes do not work well due to a hard cable corrosion, and (4) The video optical probes give clear image of the flow pattern.

**46533 (JAERI-M—84-131) Report on reflood experiment of grid spacer effect.** Sugimoto, Jun; Murao, Yoshio. (Japan Atomic Energy Research Inst., Tokyo). Jul 1984. 230p. NTIS (US Sales Only), PC A11/MF A01. File Number DE85702198.

Experiments were performed in order to clarify the effect of grid spacers on reflood heat transfer in PWR-LOCA. The flow pattern, the thermal responses and the water accumulation near the grid spacer were investigated by shifting the grid spacer at the midplane of the simulated core. Also tested is the effect of the thickness of the grid spacer wall on the reflood behavior. The heat transfer coefficient before the quenching was about 20 to 50 percent higher just above the grid spacer than just below the grid spacer. The decrease of the droplet diameter due to the grid spacer was observed in the droplet dispersed flow regime. In the slug flow regime, the grid spacer was rewetted early in the reflood transient and the increased water accumulation near the grid spacer was observed. Hence, the heat transfer enhancement due to the grid spacer is mainly attributed to the increased interfacial surface area of droplets in the dispersed flow and also to the increased film boiling heat transfer in the slug flow. The heat transfer enhancement tended to be larger with the larger thickness of the grid spacer. The simple model was developed for both the dispersed flow and slug flow regimes based on the present experimental results. The thermohydraulic behavior near the grid spacer was well calculated with the developed model. The further detailed information, however, is required for the improvement and the verification of the grid spacer model.

**46534 (JAERI-M—84-132) Through calculation of 1,100 MWe PWR large break LOCA by THYDE-P1 EM model. Sample calculation Run 80.** Kanazawa, Masayuki; Asahi, Yoshiro; Hirano, Masashi. (Japan Atomic Energy Research Inst., Tokyo). Jul 1984. 107p. NTIS (US Sales Only), PC A06/MF A01. File Number DE85702199.

THYDE-P1 is a code to analyze both the blowdown and refill-reflood phases of loss-of-coolant accidents (LOCAs) of pressurized water reactors (PWRs). Up to now, THYDE-P1 has been applied to various experiment analyses, which show its high capability to analyze LOCAs as a best estimate (BE) calculation code. In this report, evaluation model (EM) calculation method, especially in the blowdown and refill phases, is established equivalently to WREM/J2 which is regarded as appropriate for an EM calculation code, and the results of them are compared and discussed. The present calculation was the first executed by THYDE-P1-EM, and was performed as Sample Calculation Run 80 which was a part of a series of THYDE-P sample calculations. The calculation was carried out from the LOCA initiation till 400 seconds for a guillotine break at the cold leg of a commercial 1,100 MWe PWR plant. The calculated results agreed well to that of the WREM/J2 code.

**46535 (JAERI-M—84-135) Recirculation pump suction line 200% break integral test at ROSA-III with two LPCI failures, Run 983.** Suzuki, Mitsuhiro; Anoda, Yoshinari; Tasaka, Kanji; Kumamaru, Hiroshige; Nakamura, Hideo; Yonomoto, Taisuke; Murata, Hideo; Shiba, Masayoshi. (Japan Atomic Energy Research Inst., Tokyo). Aug 1984. 220p. NTIS (US Sales Only), PC A10/MF A01. File Number DE85702193.

This report presents the experimental data of the 200% suction line break test RUN 983 at ROSA-III, which was conducted as one of counterpart tests to a FIST program test sponsored by GE, EPRI and USNRC. The similarity study between the ROSA-III and FIST tests is on the way. The report also presents the information on the ROSA-III test facility, experiment conditions, experiment results and the effects of the power generation rate, feedwater temperature and the MSIV trip level comparing with another 200% break test, RUN 902. Major conclusions obtained are as follows. (1) Change of the MSIV trip level from L2 to L1 gives little change in pressure response and mass inventory in the large recirculation line break test. (2) Feedwater flashing results in reduction of depressurization and delay in the LPCS and LPCI actuations, which cause higher PCT. (3) The lower PCT in RUN 983 is the results of lower heat flux and larger mass inventory compared with that of RUN 902.

**46536 (KFK—3709) Experimental investigation of flow dynamics in the SNR-upper-core structure.** Meyer, L. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Neutronenphysik und Reaktortechnik; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Schneller Brueter). Mar 1985. 158p. B. File Number DE85752241.

This report describes the results of a simulant-material experimental investigation of flow dynamics in the upper-core (UCS) during a HCDA of a LMFBR. The experiments were designed to verify some of the thermal-hydraulic models in SIMMER-II. Four different liquids were used to simulate the flashing $UO_2$; and numerous parameter variations were made regarding initial pressure, temperature, and configurations of the test apparatus. The experiments showed the large effect of the heat transfer in the UCS and the relatively small effect of friction. The reduction in final kinetic energy by the presence of the UCS is shown as a function of the initial pressure and the temperature difference between core and UCS. Calculations with SIMMER-II for the wide range of experiments produced results for the kinetic energy within a factor of 2 of the experimental results without changing the crucial input parameters. The minimum droplet size during the flashing process and the structure-side heat transfer coefficient were determined to be the crucial and most sensitive parameters. This reflects deficiencies in modeling of both the flashing process and the transient heat conduction in the structure.

**46537 (KFK—3907) Comparison of the foodchain transport models of WASH-1400 and MARC using the accident consequence model UFOMOD.** Steinhauer, C. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Neutronenphysik und Reaktortechnik; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Nukleare Sicherheit). Apr 1985. 78p. NTIS (US Sales Only), PC A05/MF A01. File Number DE85752328.

Within the frame of the contract with the European Community 'Methods for Assessing the Radiological Impact of Accidents' (CEC-MARIA) comparative accident consequence assessments were performed with the computer code UFOMOD, replacing the currently implemented foodchain transport model of the WASH-1400 study by the dynamic transport model of the MARC methodology. The calculations were based on the release category FK2 of the German Risk Study with meteorological data representing four different regions of the Federal Republic of Germany. The study of seasonal variations was carried out with the MARC data for four representative times of deposition with an agricultural practice adopted in the UK. In this report the differences are presented which are observed in the potential doses due to ingestion, the areas affected by food-bans and the late health effects when using both models and taking the influence of seasonal effects into account.

**46538 (KFK—3921) Analysis of pressure oscillations due to condensation in LWR pressure suppression systems.** Class, G. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorentwicklung). May 1985. 69p. (In German). NTIS (US Sales Only), PC A04/MF A01. File Number DE85752329.

Analysis of Pressure Oscillation due to Condensation in LWR Pressure Suppression Systems - Computer Program VOICE - the exitations of the pressure variations in the LWR pressure suppression system (PSS) during steam condensation is described in the VOICE computer code by volume sources which are effective at the locations of vent pipe exits. The prerequisite is that the pressure transfer function in the water pool is known. This allows to calculate from condensation experiments and to extrapolate to other PSS configurations the time dependent volume sources. To describe the pressure transfer function in the water pool VOICE includes a three-dimensional model representing the acoustic wave propagation in cylindrical and ring-shaped fluid configurations, respectively, with free surfaces. Also the frequency dependent influence of gas voids dispersed in the fluid can be taken into account with this model. The theoretical basis, the program structure and the program parameters of VOICE are indicated. The computer code is qualified with the help of trial examples and its applicability is dem-

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onstrated by the example of some condensation tests performed by the Kraftwerk-Union company.

46539 **(MIT/EL—83-009) Analytical modelling of hydrogen transport in reactor containments.** Manno, V.P.; Golay, M.W. (Massachusetts Inst. of Tech., Cambridge (USA). Energy Lab.). Oct 1983. 329p. NTIS, PC A15/MF A01; 1; GPO Dep. File Number DE85017259.

A versatile computational model of hydrogen transport in nuclear plant containment buildings is developed. The background and significance of hydrogen-related nuclear safety issues are discussed. A computer program is constructed that embodies the analytical models. The thermofluid dynamic formulation spans a wide applicability range from rapid two-phase blowdown transients to slow incompressible hydrogen injection. Detailed ancillary models of molecular and turbulent diffusion, mixture transport properties, multi-phase multicomponent thermodynamics and heat sink modelling are addressed. The numerical solution of the continuum equations emphasizes both accuracy and efficiency in the employment of relatively coarse discretization and long time steps. Reducing undesirable numerical diffusion is addressed. Problem geometry options include lumped parameter zones, one dimensional meshes, two dimensional Cartesian or axisymmetric coordinate systems and three dimensional Cartesian or cylindrical regions. An efficient lumped nodal model is included for simulation of events in which spatial resolution is not significant. Several validation calculations are reported. Demonstration problems include the successful reproduction of analytical or known solutions, simulation of large scale experiments and analyses of "thought experiments" which test the physical reasonableness of the predictions. In particular, simulation of hydrogen transport tests performed at the Battelle Frankfurt Institute and Hanford Engineering Development Laboratory show good agreement with measured hydrogen concentration, temperature and flow fields. The results also indicate that potential areas of improvement are enhanced computational efficiency, further reduction of numerical diffusion and development of containment spray models. Overall, a useful tool applicable to many nuclear safety problems is described.

46540 **(NUREG—0090-Vol.8-No.1) Report to Congress on abnormal occurrences, January-March 1985. Volume 8, No. 1.** (Nuclear Regulatory Commission, Washington, DC (USA). Office for Analysis and Evaluation of Operational Data). Aug 1985. 42p. NTIS, PC A03/MF A01 - GPO. File Number TI85901845.

Section 208 of the Energy Reorganization Act of 1974 identifies an abnormal occurrence as an unscheduled incident or event which the Nuclear Regulatory Commission determines to be significant from the standpoint of public health or safety and requires a quarterly report of such events to be made to Congress. This report covers the period from January 1 to March 31, 1985. The report states that for this reporting period, there was one abnormal occurrence at the nuclear power plants licensed to operate; the event involved a premature criticality during reactor startup. There were three abnormal occurrences at the other NRC licensees. Two events involved diagnostic medical misadministrations and the other event involved unlawful possession of radioactive material. There were four abnormal occurrences reported by an Agreement State (Texas). Three events involved radiation overexposures; the other event involved a well logging source which was apparently stolen, but later was recovered. The report also contains information updating some previously reported abnormal occurrences.

46541 **(NUREG—1030) Seismic qualification of equipment in operating nuclear power plants. Unresolved safety issue A-46, draft report for comment.** Chang, T.Y. (Nuclear Regulatory Commission, Washington, DC (USA). Div. of Safety Technology). Aug 1985. 210p. NTIS, PC A10/MF A01 - GPO. File Number TI85902119.

The margin of safety provided in existing nuclear power plant equipment to resist seismically induced loads and perform their intended safety functions may vary considerably, because of significant changes in design criteria and methods for the seismic qualification of equipment over the years. Therefore, the seismic qualification of equipment in operating plants should be reassessed to determine whether requalification is necessary. The objective of technical studies performed under the Task Action Plan A-46 was to establish an explicit set of guidelines and acceptance criteria to judge the adequacy of equipment under seismic loading at all operating plants, in lieu of requiring qualification to the current criteria that are applied to new plants. This report summarizes the work accomplished on USI A-46 by the Nuclear Regulatory Commission staff and its contractors, Idaho National Engineering Laboratory, Southwest Research Institute, Brookhaven National Laboratory, and Lawrence Livermore National Laboratory. In addition, the collection and review of seismic experience data by the Seismic Qualification Utility Group and the review and recommendations of a group of seismic consultants, the Senior Seismic Review Advisory Panel, are presented. Staff assessment of work accomplished under USI A-46 leads to the conclusion that the use of seismic experience data provides the most reasonable alternative to current qualification criteria. Consideration of seismic qualification by use of experience data was a specific task in USI A-46. Several other A-46 tasks serve to support the use of an experience data base.

46542 **(NUREG—1154) Loss of main and auxiliary feedwater event at the Davis-Besse Plant on June 9, 1985.** (Nuclear Regulatory Commission, Washington, DC (USA)). Jul 1985. 100p. NTIS, PC A05/MF A01 - GPO. File Number TI85902000.

On June 9, 1985, Toledo Edison Company's Davis-Besse Nuclear Power Plant, located in Ottawa County, Ohio, experienced a partial loss of feedwater while the plant was operating at 90% power. Following a reactor trip, a loss of all feedwater occurred. The event involved a number of equipment malfunctions and extensive operator actions, including operator actions outside the control room. Several operator errors also occurred during the event. This report documents the findings of an NRC Team sent to Davis-Besse by the NRC Executive Director for Operations in conformance with the staff-proposed Incident Investigation Program.

46543 **(NUREG/CR—1288) Fission product source terms for the LWR loss-of-coolant accident.** Lorenz, R.A.; Collins, J.L.; Malinauskas, A.P. (Oak Ridge National Lab., TN (USA)). Jul 1980. Contract AC05-84OR21400. 32p. (ORNL/NUREG/TM—321). NTIS, PC A03/MF A01 - GPO. File Number TI85015937.

Models for cesium and iodine release from light-water reactor (LWR) fuel rods failed in steam were formulated based on experimental fission product release data from several types of failed LWR fuel rods. The models were applied to a pressurized water reactor (PWR) undergoing a hypothetical loss-of-coolant accident (LOCA) temperature transient. Calculated total iodine and cesium releases from the fuel rods were 0.053 and 0.025% of the total reactor inventories of these elements, respectively, with most of the release occurring at the time of rupture. These values are approximately two orders of magnitude less than releases used in WASH-1400, the Reactor Safety Study.

46544 **(NUREG/CR—1480) Summary of thermal-hydraulic calculations for a pressurized water reactor.** Bolstad, J.W.; Haarman, R.A. (Los Alamos National Lab., NM (USA)). May 1980. Contract W-7405-ENG-36. 25p. (LA—8361-MS). NTIS, PC A02/MF A01 - GPO. File Number TI85015912.

The results of two transients involving the loss of a steam generator in a single-pass, steam generator, pressurized water reactor have been analyzed using a state-of-the-art, thermal-hydraulic computer code. Computed results include the formation of a steam bubble in the core while the pressurizer is solid. Calculations show that continued injection of high pressure water would have stopped the scenario. These are similar to the happenings at Three Mile Island.

46545 **(NUREG/CR—1558) BWR refill-reflood program: core spray distribution experimental task plan.** Eckert, T. (General Electric Co., San Jose, CA (USA)). Feb 1981. 55p. (EPRI-NP—1523; GEAP—25272). Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI85920182.

An experimental task plan for the BWR/4 core spray task of the Refill-Reflood Test Program is presented. The test program

will provide core spray distribution data for a 30 degree sector of the BWR/4 & 5-218 design. This design uses different nozzle types and different sparger elevations than the BWR/6-218 design which was tested previously. Test parameter ranges are specified; individual tests are defined; and measurement and data utilization plans are defined.

46546 **(NUREG/CR—1837) Blowdown heat transfer separate-effects program. Quarterly progress report, July-September 1980.** White, J.D.; Cook, D.H.; Craddick, W.G.; Felde, D.K.; Flanders, R.M.; Hagar, R.C.; Mailen, G.S.; Ott, L.J.; Hyman, C.R. (Oak Ridge National Lab., TN (USA)). Jan 1981. Contract AC05-84OR21400. 15p. (ORNL/NUREG/TM—425). NTIS, PC A02/MF A01 - GPO. File Number TI85015922.

Four transient and thirteen steady-state tests were completed in the period July through October 3, 1980. All tests except one were for dispersed flow film boiling in upflow. Analysis of results is still under way. Early results indicate that the Dougall-Rohsenow correlation overpredicted experimental heat transfer by factors of 2 to 3, while the Groeneveld 5.7 and 5.9 correlations predicted data better. Calculations using COBRA-TRAC indicated significant nonequilibrium in those tests. The other test was a large break loss-of-coolant accident simulation to investigate core thermal-hydraulics behavior, which includes time to critical heat flux (CHF). The test provides a data base for benchmarking advanced thermal-hydraulic computer codes for flat power profile 17 by 17 pressurized water reactor subassemblies. Linear rod power was 3.15 kW/m (10.35 kW/ft) before blowdown; power was decreased after blowdown by a predetermined program. All sheath thermocouples indicated CHF. Earliest time to CHF was 0.44 s, and latest was 1.538 s. Several instrument modifications were made to the Thermal-Hydraulic Test Facility.

46547 **(NUREG/CR—2204-Vol.2) Advanced Two-Phase Flow Instrumentation Program. Quarterly progress report, April-June 1981. Volume 2.** Hardy, J.E.; Rogers, S.C.; Miller, G.N. (Oak Ridge National Lab., TN (USA)). Oct 1981. Contract AC05-84OR21400. 19p. (ORNL/TM—8010). NTIS, PC A02/MF A01 - GPO. File Number TI85015990.

Preliminary evaluation of a reactor level instrumentation system located at the Semiscale Test Facility at EG and G Idaho was completed. This instrumentation system was designed to monitor core cooling status by using differential pressure (dP) transmitters to give an indication of in-vessel collapsed liquid level. The dP system is required to yield a reliable and unambiguous indication of water level for the full range of steady-state and transient conditions. To aid in evaluating data from the liquid level instrumentation, dP data taken from the Thermal Hydraulic Test Facility were analyzed. Results showed that pressure-drop cell output provided information relative to core liquid level in some cases. However, problem areas that might lead to incorrect reactor operator response were observed where pressure-drop data indicated collapsed liquid levels above the core quench front.

46548 **(NUREG/CR—2815-Vol.1-Rev.1) Probabilistic safety analysis procedures guide. Sections 1-7 and appendices. Volume 1, Revision 1.** Bari, R.A.; Buslik, A.J.; Cho, N.Z.; El-Bassioni, A.; Fragola, J.; Hall, R.E.; Ilberg, D.; Lofgren, E.; O'Brien, J.; Papazoglou, I.A. (Brookhaven National Lab., Upton, NY (USA)). Aug 1985. Contract AC02-76CH00016. 204p. (BNL-NUREG—51559-Vol.1-Rev.1). NTIS, PC A10/MF A01 - GPO. File Number TI85017857.

A procedures guide for the performance of probabilistic safety assessment has been prepared for interim use in the Nuclear Regulatory Commission programs. It will be revised as comments are received, and as experience is gained from its use. The probabilistic safety assessment studies performed are intended to produce probabilistic predictive models that can be used and extended by the utilities and by NRC to sharpen the focus of inquiries into a range of issues affecting reactor safety. This first volume of the guide describes the determination of the probability (per year) of core damage resulting from accident initiators internal to the plant (i.e., intrinsic to plant operation) and from loss of off-site electric power. The scope includes human reliability analysis, a determination of the importance of various core damage accident sequences, and an explicit treatment and display of uncertainties for key accident sequences. The second volume deals with the treatment of the so-called external events including seismic disturbances, fires, floods, etc. Ultimately, the guide will be augmented to include the plant-specific analysis of in-plant processes (i.e., containment performance). This guide provides the structure of a probabilistic safety study to be performed, and indicates what products of the study are valuable for regulatory decision making. For internal events, methodology is treated in the guide only to the extent necessary to indicate the range of methods which is acceptable; ample reference is given to alternative methodologies which may be utilized in the performance of the study. For external events, more explicit guidance is given.

46549 **(NUREG/CR—2815-Vol.2-Rev.1) Probabilistic safety analysis procedures guide, Sections 8-12. Volume 2, Rev. 1.** McCann, M.; Reed, J.; Ruger, C.; Shiu, K.; Teichmann, T.; Unione, A.; Youngblood, R. (Brookhaven National Lab., Upton, NY (USA)). Aug 1985. Contract AC02-76CH00016. 369p. (BNL-NUREG—51559-Vol.2-Rev.1). NTIS, PC A16/MF A01 - GPO. File Number TI85017858.

A procedures guide for the performance of probabilistic safety assessment has been prepared for interim use in the Nuclear Regulatory Commission programs. It will be revised as comments are received, and as experience is gained from its use. The probabilistic safety assessment studies performed are intended to produce probabilistic predictive models that can be used and extended by the utilities and by NRC to sharpen the focus of inquiries into a range of issues affecting reactor safety. The first volume of the guide describes the determination of the probability (per year) of core damage resulting from accident initiators internal to the plant (i.e., intrinsic to plant operation) and from loss of off-site electric power. The scope includes human reliability analysis, a determination of the importance of various core damage accident sequences, and an explicit treatment and display of uncertainties for key accident sequences. This second volume deals with the treatment of the so-called external events including seismic disturbances, fires, floods, etc. Ultimately, the guide will be augmented to include the plant-specific analysis of in-plant processes (i.e., containment performance). This guide provides the structure of a probabilistic safety study to be performed, and indicates what products of the study are valuable for regulatory decision making. For internal events, methodology is treated in the guide only to the extent necessary to indicate the range of methods which is acceptable; ample reference is given to alternative methodologies which may be utilized in the performance of the study. For external events, more explicit guidance is given.

46550 **(NUREG/CR—3706) TRAC analyses of severe overcooling transients for the Oconee-1 PWR.** Ireland, J.R. (comp.). (Los Alamos National Lab., NM (USA)). May 1985. Contract W-7405-ENG-36. 259p. (LA—10055-MS). NTIS, PC A12/MF A01 - GPO. File Number TI85014233.

This report describes the results of several Transient Reactor Analysis Code (TRAC)-PF1 calculations of overcooling transients in a Babcock & Wilcox lowered-loop, pressurized water reactor (Oconee-1). The purpose of this study is to provide detailed input on thermal-hydraulic data to Oak Ridge National Laboratory for pressurized thermal-shock analyses. The transient calculations performed were plant specific in that details of the primary system, the secondary system, and the plant-integrated control system of Oconee-1 were included in the TRAC input model. The results of the calculations indicate that the turbine-bypass valve failure transient was the most severe in terms of resulting in relatively cold liquid temperatures in the downcomer region of the vessel. The power-operated relief valve loss-of-coolant accident transient was the least severe in terms of downcomer liquid temperatures because of vent-valve fluid mixing and near-saturated conditions in the primary system. It is recommended that future calculations consider a wider range of operator actions to cover the spectra of overcooling transient sequences more completely. 6 refs., 287 figs., 32 tabs.

**46551 (NUREG/CR—3980-Vol.4) Light-water-reactor safety fuel systems research programs. Quarterly progress report, October-December 1984. Volume 4.** (Argonne National Lab., IL (USA)). Aug 1985. Contract W-31-109-ENG-38. 63p. (ANL—84-61-Vol.4). NTIS, PC A04/MF A01 - GPO. File Number TI85017823.

This progress report summarizes work performed by the Materials Science and Technology Division of Argonne National Laboratory during October, November, and December 1984 on water reactor safety problems related to fuel and cladding. The research and development areas covered are Transient Fuel Response and Fission Product Release and Clad Properties for Code Verification. 30 refs., 23 figs., 2 tabs.

**46552 (NUREG/CR—4081) Absorption of gaseous iodine by water droplets.** Albert, M.F. (Oak Ridge National Lab., TN (USA)). Jul 1985. Contract AC05-84OR21400. 210p. (ORNL/TM—9488). NTIS, PC A10/MF A01 - GPO. File Number TI85014908.

A new model has been developed for predicting the rate at which gaseous molecular iodine is absorbed by water sprays. The model is a quasi-steady state mass transfer model that includes the iodine hydrolysis reactions. The parameters of the model are spray drop size, initial concentration of the gas and liquid phases, temperature, pressure, buffered or unbuffered spray solution, spray flow rate, containment diameter and drop fall height. The results of the model were studied under many values of these parameters. Plots of concentration of iodine species in the drop versus time have been produced by varying the initial gas phase concentration of molecular iodine over the range of $1 \times 10^{-5}$ moles/liter to $1 \times 10^{-10}$ moles/liter and a drop size of 1000 microns. Results from the model are compared to results available from Containment Systems Experiments at Pacific Northwest Laboratory. The difference between the model predictions and the experimental data ranges from -120.5% to 68.0% with the closest agreement 7.7%. The new spray model is also compared to previously existing spray models. At high concentrations of gaseous molecular iodine, the new spray model is considered to be less accurate but at low concentrations, the new model predicts results that are closer to the experimental data than the model called the realistic model from WASH-1329. Inclusion of the iodine hydrolysis reaction is shown to be a feature important to a model intended for determining the removal of molecular iodine over a wide range of conditions.

**46553 (NUREG/CR—4255-Vol.1) Aerosol release and transport program. Semiannual progress report, October 1984-March 1985. Volume 1.** Adams, R.E.; Tobias, M.L. (Oak Ridge National Lab., TN (USA)). Jul 1985. Contract AC05-84OR21400. 49p. (ORNL/TM—9632/V1). NTIS, PC A03/MF A01 - GPO. File Number TI85014645.

This report summarizes progress for the Aerosol Release and Transport Program sponsored by the Nuclear Regulatory Commission, Office of Nuclear Regulatory Research, Division of Accident Evaluation, for the period October 1984 - March 1985. Topics discussed include: (1) steam-only experiments in the NSPP facility; (2) tests in small vessels to study thermal output, mass generation rates, and other operating features of plasma torch aerosol generators in support of the development of the Aerosol Moisture Interaction Tests (AMIT) facility and to support the LWR Aerosol Containment Experiments (LACE) program at Hanford; (3) analysis of data from plasma torch aerosol generator tests; (4) analysis of steam behavior in the NSPP vessel in aerosol experiments and in steam only tests; and (5) a study of the feasibility of experiments for shape factor measurements.

**46554 (NUREG/CR—4280) Effects of supervisor experience and assistance of a Shift Technical Advisor (STA) on crew performance in control room simulators.** Beare, A.N.; Donovan, M.D.; Lassiter, D.L.; Gray, L.H. (Oak Ridge National Lab., TN (USA)). Sep 1985. Contract AC05-84OR21400. 197p. (ORNL/TM—9660). NTIS, PC A09/MF A01 - GPO. File Number TI85017413.

This report describes the second experiment in a Nuclear Regulatory Commission-sponsored program of training simulator experiments to evaluate the effects of selected performance shaping factors on the performance of nuclear power plant control room operators. The factors investigated were the experience level of the Senior Reactor Operator (SRO) in the supervisor's role and the presence of a Shift Technical Advisor (STA) to assist the operating crew. The experiment was conducted in the plant-referenced training simulator for a 1100 MWe pressurized water reactor (PWR) plant. Data were collected from 20 three-man crews of licensed operators. The crews were split into "high" and "low" experience groups on the basis of the supervisor's years of experience as an SRO. One half of the high- and low-SRO experience groups were assisted by an STA. No significant differences in overall performance were found between groups led by "high" and "low" experience supervisors. The presence of the STA had no effect on overall team performance. These results were identical to the results of a similar experiment performed with BWR crews in 1983.

**46555 (NUREG/CR—4314) Brief survey and comparison of common cause failure analysis.** Waller, R.A. (Los Alamos National Lab., NM (USA)). Jun 1985. Contract W-7405-ENG-36. 27p. (LA—10474-MS). NTIS, PC A03/MF A01 - GPO. File Number TI85016129.

This paper presents a brief survey of methods and a list of references for analyzing common cause (mode) failures. Implicit models, explicit modeling techniques, and computer aids are included in the discussion. It is suggested that although current trends are emphasizing development of explicit models, a realistic assessment of data availability will force continued use of implicit or hybrid models in the immediate future. 137 refs.

**46556 (ORNL—6147) US Department of Energy participation in the 1984 Federal Field Exercise.** Adler, M.V.; Gant, K.S. (Oak Ridge National Lab., TN (USA)). Sep 1985. Contract AC05-84OR21400. 148p. NTIS, PC A07/MF A01; 1; GPO Dep. File Number DE85018115.

The first full-scale field exercise of the newly developed Federal Radiological Emergency Response Plan (FRERP) was held in March 1984 at the St. Lucie Nuclear Power Plant. The exercise, run in conjunction with the Nuclear Regulatory Commission (NRC) and Federal Emergency Management Agency (FEMA) required compliance exercise at the plant, involved Florida Power and Light Company, the state of Florida, Martin and St. Lucie counties, volunteer groups, and representatives from 11 Federal agencies. Approximately 1000 persons participated in the three-day exercise, which simulated an accident that resulted in the release of radioactive materials outside the plant boundaries. The report outlines DOE's participation in all phases of the interagency planning and response process. This participation included the development of the scenario and the regional response plans, as well as the control and evaluation of the field exercise and the two preliminary exercises. The successful completion of the exercise resulted in the publication in September 1984 of the FRERP as an interim, but operational, plan. As of the publication data of this report, DOE, FEMA, NRC, USDA, EPA, the Department of Commerce, and the National Communications System have formally concurred in the FRERP. 16 figs.

**46557 (PNL-SA—9322) Doses incurred while crossing a radioactive plume.** Scherpelz, R.I.; Desrosiers, A.E. (Pacific Northwest Labs., Richland, WA (USA)). Jun 1981. Contract AC06-76RL01830. 21p. (CONF-8106144—10). NTIS, PC A02/MF A01 - GPO. File Number TI85016690.

From Health Physics Society annual meeting; Louisville, KY, USA (21 Jun 1981).

During an accidental release of radioactive material, officials responsible for the health and safety of the affected population must make a number of decisions to minimize the doses resulting from the accident. Usually strategies such as evacuation, or sheltering and subsequent relocation, would be expected to minimize exposure to the plume and, therefore, result in the lowest population doses. In certain cases, however, it may be necessary for people to move across the plume. Such crossings might be made by emergency medical or security workers or by workers performing tasks such as monitoring the plume. For such circumstances, it would be important to have a good estimate of the dose received by the person crossing the plume. This paper presents the results of a set of cross-plume doses for three hypothetical accident scenarios. The methods used in performing the calculations are outlined and the resulting

doses compared to the EPA's Protective Action Guide doses. The accident scenarios and meteorological conditions were chosen to be general rather than site specific.

46558 **(PNL-SA—13161) Classification of reactor decommissioning wastes.** Murphy, E.S.; Feldman, C.; Cardile, F.P. (Pacific Northwest Labs., Richland, WA (USA)). Jun 1985. Contract AC06-76RL01830. 11p. (CONF-850720—4). NTIS, PC A02/MF A01 - GPO. File Number TI85016912.

From International nuclear reactor decommissioning planning conference; Bethesda, MD, USA (16 Jul 1985).

Nuclear wastes from the conceptual decommissioning of a reference PWR and a reference BWR have been analyzed in terms of the waste classification requirements of 10 CFR 61 to determine the suitability of these wastes for disposal by shallow-land burial. Most of the nuclear waste from LWR decommissioning (approximately 80% to 98% of the total waste volume, depending on reactor type and decommissioning alternative) is considered to have radionuclide concentrations that permit its classification as Class A waste. A relatively small amount of the waste (approximately 1% to 15% of the total waste volume, depending on reactor type and decommissioning alternative) is considered to be Class B waste. Some neutron-activated stainless-steel reactor vessel internals with high concentrations of $^{59}Ni$, $^{63}Ni$, and $^{94}Nb$ are considered to be Class C waste or waste that exceeds Class C limits.

46559 **(SAND—81-0326C) Review of $H_2$ and $O_2$ detection in LWRs .** Neidel, E.C.; Castle, J.G. Jr. (Sandia National Labs., Albuquerque, NM (USA)). [1985]. Contract AC04-76DP00789. 36p. (CONF-810120—4). NTIS, PC A03/MF A01 - GPO. File Number TI85016710.

From Workshop on the impact of hydrogen on water reactor safety; Albuquerque, NM, USA (26 Jan 1981).

Hydrogen detection systems are being installed in existing LWR's and are being planned for new ones. This review summarizes the present status of instrument availability and of application in nuclear power plants. The $H_2$ sensors in most of the detection systems purchased to date by the nuclear utilities are being located outside of containment. The air sampled for each $H_2$ sensor is circulated outside to the analyzer and back through two pipes which penetrate the containment wall. The travel time for the air to reach the sensor increases the response time for $H_2$ detection by approximately one-half minute. A few of the utilities will operate their $H_2$ sensors inside LWR containment. Since these systems lack radiation-hardened electronics, they require multiple wire penetrations which considerably increase installation costs and reduce the attractiveness of these systems. One electric power utility has requested quotations from hydrogen detector manufacturers for hydrogen detection equipment with better performance and faster system response than that presently available commercially. The requested detector response time of 15 seconds or less would permit the decision delay prior to initiating hydrogen control measures to be on the order of one minute.

46560 **(SAND—84-0763) Sandia Sodium Purification Loop (SNAPL) description and operations manual.** Acton, R.U.; Weatherbee, R.L.; Smith, L.A.; Mastin, F.L.; Nowotny, K.E. (Sandia National Labs., Albuquerque, NM (USA)). Aug 1985. Contract AC04-76DP00789. 95p. NTIS, PC E05/MF A01; 1; GPO Dep. File Number DE85017353.

Sandia's Sodium Purification Loop was constructed to purify sodium for fast reactor safety experiments. An oxide impurity of less than 10 parts per million is required by these in-pile experiments. Commercial, reactor grade sodium is purchased in 180 kg drums. The sodium is melted and transferred into the unit. The unit is of a loop design and purification is accomplished by "cold trapping." Sodium purified in this loop has been chemically analysed at one part per million oxygen by weight. 5 refs., 22 figs., 7 tabs.

46561 **(TFBP-TR—320) PBF/LOFT Lead Rod Program Test LLR-4A Quick Look Report.** Varacalle, D.J. Jr.; Garner, R.W. (EG and G Idaho, Inc., Idaho Falls (USA)). Jun 1979. Contract AC07-76ID01570. 55p. NTIS, PC A04/MF A01 - GPO. File Number TI85016692.

This report describes the prliminary results of the PBF/LOFT Lead Rod (LLR) Program Test LLR-4A conducted in the Power Burst Facility Test Reactor at the Idaho National Engineering Laboratory. Test LLR-4A was conducted on May 18, 1979. The PFB/LLR Tests (LLR-3, LLR-5, and LLR-4) were designed to simulate the test conditions for LOFT loss-of-coolant experiment (LOCEs) tests L2-3 through L2-5. Test LLR-4A was added to the PBF/LLR program following completion of Test LLR-4 to investigate the effects of preconditioning and a successive LOCE transient on deformed fuel rods. The test conditions and performance sequence for this test were identical to the LLR-4 test.

46562 **(UCID—18656) Technical evaluation of the end-of-cycle recirculation pump trip for Brunswick Steam Electric Plant Unit No.2.** Peterson, L.R. (Lawrence Livermore National Lab., CA (USA)). May 1980. Contract W-7405-ENG-48. 19p. NTIS, PC A02/MF A01 - GPO. File Number TI85016677.

This report documents the technical evaluation of the end-of-cycle recirculation pump trip for the Brunswick Steam Electric Plant Unit No. 2. The review criteria are based on IEEE Std-279-1971, IEEE Std-323-1974, IEEE Std-338-1977, and General Design Criteria 13, 20 through 24, and 29 of the Code of Federal Regulations, Title 10, Part 50, Appendix A requirements for determining the acceptability of the proposed system.

46563 **(UCID—18657) Technical evaluation of the electrical, instrumentation, and control design aspects of the low temperature overpressure protection system for the Kewaunee Nuclear Power Plant.** Latorre, V.R. (Lawrence Livermore National Lab., CA (USA)). May 1980. Contract W-7405-ENG-48. 23p. NTIS, PC A02/MF A01 - GPO. File Number TI85016676.

This report documents the technical evaluation of the electrical, instrumentation, and control design aspects for the low temperature overpressure protection system of the Kewaunee Nuclear Power Plant. Design basis criteria used to evaluate the acceptability of the system included operator action, system testability, single failure criterion, and seismic Category I and IEEE Std-279-1971 criteria.

46564 **(UCID—18679) Utilization of emergency response facilities described in NUREG-0696.** Peterson, L.R.; Preston-Smith, J. (Lawrence Livermore National Lab., CA (USA)). Sep 1980. Contract W-7405-ENG-48. 20p. NTIS, PC A02/MF A01 - GPO. File Number TI85016672.

This report was prepared for the Emergency Preparedness Program Office, US Nuclear Regulatory Commission by Lawrence Livermore National Laboratory, California. This report was prepared in response to a request by Commissioner Victor Gilinsky. The hypothetical utilization of the Emergency Facilities (NUREG 0696) during the recent incidents at Browns Ferry 3 and Crystal River 3 is discussed.

46565 **(UCID—18692) Review of a seismic risk analysis of the decay heat removal capability of nuclear power plants.** Smith, P.D.; Bernreuter, D.L.; Bohn, M.P.; Chuang, T.Y.; Cummings, G.E.; Dong, R.G.; Johnson, J.J.; Mensing, R.W.; Wells, J.E. (Lawrence Livermore National Lab., CA (USA)). 1980. Contract W-7405-ENG-48. 51p. NTIS MF A01- GPO. File Number TI85016670.

A recent risk analysis of nuclear power plants without seismically qualified auxiliary feedwater systems is reviewed. That report suffers from several shortcomings, including the failure to account for the common-mode nature of the seismic threat, a failure to deal adequately with the complexity of the decay heat removal problem and to account for its uncertainties, and an attempt to compare results with the far more sophisticated Reactor Safety Study. Nonetheless, it is recommended that additional such probabilistic risk studies be undertaken, with the emphasis on best estimate methods and sensitivity studies rather than conservative estimates of risk. Experimental tests should also be part of reactor safety analyses.

46566 **(UCID—20508) Computing system failure probabilities: a comparison of SIGMA PI with other methods.** Thatcher, R.M.; Corynen, G.C. (Lawrence Livermore National Lab., CA (USA)). Aug 1985. Contract W-7405-ENG-48. 45p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85017693.

SIGMA PI is the fastest method available today of accurately calculating probabilities associated with large fault trees. To demonstrate this, we describe the major problems that have prevented successful evaluation of these probabilities by other methods in the past. Then, we describe how SIGMA PI addresses all of these problems, and we compare the performance of SIGMA PI with that of leading alternative methods under selected problem scenarios. 13 refs., 3 figs., 2 tabs.

46567 **(UCRL—15340) Cost and safety margin assessment of the effects of design for combination of large LOCA and SSE loads.** Stevenson, J.D. (Lawrence Livermore National Lab., CA (USA)). 1 Oct 1980. Contract W-7405-ENG-48. 41p. NTIS, PC A03/MF A01 - GPO. File Number TI85016701.

This report assesses the effect on safety and cost of the requirements to combine loss-of-coolant-accident (LOCA) and safety-shutdown earthquakes (SSE) loads in the design of nuclear power plants. Analysis is limited mainly to plants recently completed or near completion, where current definitions of LOCA and SSE loading phenomena require or may require substantial modification to as-built or in-place structures and equipment.

46568 **(UCRL—84184) Development of load combinations for design of nuclear component - a probabilistic methodology.** Cornell, C.A.; Ravindra, M.K.; Chou, C.K. (Massachusetts Inst. of Tech., Cambridge (USA); Structural Mechanics Associates, Inc., Newport Beach, CA (USA); Lawrence Livermore National Lab., CA (USA)). Jan 1981. Contract W-7405-ENG-48. 10p. NTIS, PC A02/MF A01 - GPO. File Number TI85016683.

Procedures are described for the evaluation of reliabilities implied by current component design criteria and for the sytematic derivation of design criteria that achieve specified target component reliabilities. The proposed method of calculating the limit state probability, p/sub F/, of a component considers the uncertainties of load processes and component resistances. The probability distribution of the extreme combined response is developed by convolving probability distributions of static responses with the extreme of the combined time varying dynamic responses. The probability of the component reaching a limit state is the probability that the combined maximum response exceeds the component resistance. A representative sample of components designed in accordance with a set of design criteria will have a frequency distribution of P/sub F/ that represents the limit state probability implied by the criteria set. This technique of reliability evaluation of design criteria can be used to place a new load and/or a new load combination in the proper service level category. The design criteria are derived such that the components of a particular class have approximately the same limit state probabilities. The Load and Resistance Factor design (LRFD) format, which is a generic form of the most current mechanical and structural design criteria, is selected as appropriate for load combination methodology development. The load and resistance factors are selected using an optimization procedure wherein a fuction of the difference between P/sub F/ and the target limit state procedure wherein a function of the difference between P/sub F/ and the target limit state probability, P/sub T/, is minimized over the class of components.

46569 **(UCRL—85702) Uncertainty in soil-structure interaction analysis of a nuclear power plant. Comparison of two analysis procedures.** Maslenikov, O.R.; Chen, J.C.; Johnson, J.J. (Lawrence Livermore National Lab., CA (USA); Structural Mechanics Associates, San Ramon, CA (USA)). 1981. Contract W-7405-ENG-48. 11p. (CONF-810801—93). NTIS, PC A02/MF A01 - GPO. File Number TI85016719.

From 6. international conference on structural mechanics in reactor technology; Paris, France (17 Aug 1981).

Predicting the seismic response of stiff, massive structures, such as those found at a nuclear power plant, accounting for the effect of soil-structure interaction (SSI), is subject to a number of uncertainties. A principal source of uncertainty comes from differences in SSI analysis techniques. This uncertainty and, in particular, the idealization of the soil-structure system, is the subject of this discussion.The SSI analysis of the complete Zion nuclear plant is the subject of the present study; the discussion of this paper is limited to the analysis of a single isolated reactor building.

46570 **(UCRL—85703) Issues important to the development of a systems interaction evaluation procedure.** Lim, J.J.; Alesso, H.P. (EDS Nuclear, Inc., Walnut Creek, CA (USA); Lawrence Livermore National Lab., CA (USA)). 14 Sep 1981. Contract W-7405-ENG-48. 8p. (CONF-810905—43). NTIS, PC A02/MF A01 - GPO. File Number TI85016708.

From ANS/ENS topical meeting on probabilistic risk assessment; Port Chester, NY, USA (20 Sep 1981).

Recent events such as Three Mile Island-2, Brown's Ferry-3 and Crystal River-3 have demonstrated that complex accidents can occur as a result of dependent (common cause/mode) failures. Types of events such as these are now being called Systems Interactions. A procedure for the identification and evaluation of Systems Interactions caused by dependent failures is being developed by the NRC. Several national laboratories and utilities have contributed preliminary procedures. As a result, several important aspects of the Systems Interaction problem have been highlighted. This paper will discuss several of these issues critical to the development of a Systems Interaction analysis procedure.

46571 **(UCRL—85706) Seismic Safety Margins Research Program findings (SSMRP Phase I work).** Smith, P.D.; Dong, R.G. (Lawrence Livermore National Lab., CA (USA)). Apr 1981. Contract W-7405-ENG-48. 21p. (CONF-810460—1). NTIS, PC A02/MF A01 - GPO. File Number TI85016721.

From 43. American power conference; Chicago, IL, USA (27 Apr 1981).

Objective is to develop improved requirements for seismic safety assessment of nuclear power plants. Three phases are planned. Phase I, successfully completed in January 1981, was to develop and demonstrate a probabilistic computational procedure for our investigation of the seismic safety assessment process. Phase II will use this procedure to carry out the investigation, and Phase III will develop improved requirements for seismic safety assessment. This paper provides an overview of the SSMRP and the work performed in Phase I, which was organized into eight projects. Project I was to select a typical power plant and to collect necessary dta. The Zion Nuclear Power Plant, Unit 1, north of Chicago, Illinois was selected as the demonstration plant for the computational procedure. Project II developed the tools and models necessary to describe probabilistically the seismic hazard at the Zion Site. A hazard curve was developed and 30 time histories were generated for each of six acceleration ranges spanning from 0.15g to 1.8g. In Project III the models for soil-structure interaction were developed. Models for major structural response were generated in Project IV. Project V developed models for 13 piping systems of the Zion Plant, the ones deemed most important to seismic safety. The development of fragility descriptions for components and structures is carried out in Project VI. Fragility curves are developed for 37 generic categories of compenents and five Zion structures. Project VII is to generate the systems analysis models for the Zion Plant and develop the computer code SEISIM for performing the probbilistic failure analyses. The computer code SMACS is developed in Project VIII to tie together the calculations of soil-structure interaction, major structural response, and subsystem response.

46572 **(UCRL—86209) Utilization of the emergency response facilities described in NUREG-0696.** Preston, J.; Peterson, L.R. (Lawrence Livermore National Lab., CA (USA)). Oct 1981. Contract W-7405-ENG-48. 17p. (CONF-811012—72). NTIS, PC A02/MF A01 - GPO. File Number TI85016714.

From IEEE symposium on nuclear science; San Francisco, CA, USA (21 Oct 1981).

The conceptual philosophy behind each of the Emergency Response Facilities (ERFs) is presented. The roles, responsibilities, and authorities of personnel responding to emergencies from the ERFs and the intended use of the technical information made available by each of the emergency response facilities and systems are discussed. The Browns Ferry 3 partial scram incident and the Crystal River 3 instrumentation power supply failure are reviewed and the utilization of the ERFs during these incidents is discussed. These incidents were of relatively short duration and low complexity. The malfunctions from which they resulted, however, had the potential to cause much more serious events during which the full utilization of the ERFs could have provided a greatly enhanced response capability.

46573 **(UCRL—92070) Assessment of extent and degree of thermal damage to polymeric materials in the Three Mile Island Unit 2 Reactor building.** Alvares, N.J. (Lawrence Livermore National Lab., CA (USA)). Jun 1985. Contract W-7405-ENG-48. 11p. (CONF-851098—1). NTIS, PC A02/MF A01 - GPO. File Number TI85013822.

From International fire safety meeting; Gaithersburg, MD, USA (7 Oct 1985).

This paper describes assumptions and procedures used to perform thermal damage analysis caused by post loss-of-coolant-accident (LOCA) hydrogen deflagration at Three Mile Island Unit 2 Reactor. Examination of available photographic evidence yields data on the extent and range of thermal and burn damage. Thermal damage to susceptible material in accessible regions of the reactor building was distributed in non-uniform patterns. No clear explanation for non-uniformity was found in examined evidence, e.g., burned materials were adjacent to materials that appear similar but were not burned. Because these items were in proximity to vertical openings that extend the height of the reactor building, we assume the unburned materials preferentially absorbed water vapor during periods of high, local steam concentration. A control pendant from the polar crane located in the top of the reactor building sustained asymmetric burn damage of decreasing degree from top to bottom. Evidence suggests the polar-crane pendant side that experienced heaviest damage was exposed to intense radiant energy from a transient fire plume in the reactor containment volume. Simple hydrogen-fire-exposure tests and heat transfer calculations approximate the degree of damage found on inspected materials from the containment building and support for an estimated 8% pre-fire hydrogen.

46574 **(WAPD-TM—1393) Cladding corrosion and hydriding in irradiated defected zircaloy fuel rods (LWBR Development Program).** Clayton, J.C. (Bettis Atomic Power Lab., West Mifflin, PA (USA)). Aug 1985. Contract AC11-76PN00014. 49p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85017355.

Twenty-one LWBR irradiation test rods containing $ThO_2$-$UO_2$ fuel and Zircaloy cladding with holes or cracks operated successfully. Zircaloy cladding corrosion on the inside and outside diameter surfaces and hydrogen pickup in the cladding were measured. The observed outer surface Zircaloy cladding corrosion oxide thicknesses of the test rods were similar to thicknesses measured for nondefected irradiation test rods. An analysis model, which was developed to calculate outer surface oxide thickness of non-defected rods, gave results which were in reasonable agreement with the outer surface oxide thicknesses of defected rods. When the analysis procedure was modified to account for additional corrosion proportional to fission rate and to time, the calculated values agreed well with measured inner oxide corrosion film values. Hydrogen pickup in the defected rods was not directly proportional to local corrosion oxide weight gain as was the case for non-defected rods. 16 refs., 6 figs., 8 tabs.

46575 **Potassium iodide: predistribution or not? The real emergency preparedness issue.** Martin, J.A. Jr. (Nuclear Regulatory Commission, Washington, DC). *Health Physics;* 49: No. 2, 287-289(Aug 1985).

A recent review article provided a broad sample of literature regarding the administration of potassium iodide (KI) to reduce thyroid dose upon inhalation or radioiodine. Unfortunately, the article failed to address a fundamental point, to wit: for emergency preparedness, the KI issue reduces to the question: should KI be predistributed or not? This note will shed some light on this narrow, yet fundamental question.

46576 **(NUREG/TR—0022) Investigations into brittle fracture behavior of thick-walled hollow cylinders subjected to thermal shock.** Blauel, J.G.; Stahn, D.; Kalthoff, J.F. (Nuclear Regulatory Commission, Washington, DC (USA); Fraunhofer-Gesellschaft zur Foerderung der Angewandten Forschung e.V., Freiburg im Breisgau (Germany, F.R.). Inst. fuer Festkoerpermechanik). Jan 1978. Translation of BMFT RS-61, 1972. 93p. NTIS, PC A05/MF A01 - GPO. File Number TI85901900.

Model experiments were carried out to investigate the brittle fracture behavior of a reactor pressure vessel under conditions of an emergency core cooling. For this, uniformly heated hollow cylinders made of glass with well defined precracks were shock-cooled by flowing water. Temperatures and times to fracture were measured and the fracture surfaces created by one or a series of shock loadings, were inspected and evaluated after the experiment. They delivered fundamental information about the time-dependent three-dimensional crack extension which can be interpreted by theoretical-numerical analysis on the basis of linear-elastic fracture mechanics. It is shown that for running brittle cracks, there is an arrest potential from the thermal stress field conditions. The applicability of these results to a real reactor situation is discussed under special consideration of the material conditions.

# 25 ENERGY STORAGE

*REFER ALSO TO CITATION(S) 46645, 46646*

## 2501 Magnetic

46577 **(ANL-HEP-CP—85-61) Microcomputer controlled current sharing experiments with parallel convertors.** Kustom, R.L.; Skiles, J.J. (Argonne National Lab., IL (USA); Wisconsin Univ., Madison (USA)). 1985. Contract W-31-109-ENG-38. 5p. (CONF-851071—2). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85013854.

From IEEE-Industry Applications Society annual meeting; Toronto, Ontario, Canada (6 Oct 1985).

Power conditioning circuits for a Superconductive Magnetic Energy Storage (SMES) coil will require many parallel SCR devices because the operating current is planned to be as high as a few hundred thousand amperes. In order to maintain current balance in the parallel units, a microcomputer controlled system that adjusts the delay angle of individual units is envisioned. Studies and tests on an 8-H model with two parallel 9 kVA bridge circuits are described.

## 2505 Flywheels

46578 **(EUR—9559-DE) Development of a flywheel energy store for use in crane drives in order to save energy.** Ender, H.; Hejj, E.; Klein, P.; Manthey, H.; Nover, M.; Sigl, D. (Commission of the European Communities, Luxembourg. Directorate-General for Information, Market and Innovation). 1984. 60p. (In German). Commission of the European Communities, Luxembourg. Office of Official Publications of the European Communities.

The use of a flywheel to store energy in crane operation is examined from both a commercial and a technical viewpoint. Back-to-back tests were conducted between a flywheel storage device, mechanically connected to the hoist drive through gearing and a fly-wheel storage device electrically coupled to the hoist drive through the electrical supply system. An economic feasibility study shows, in terms of energy cost savings, the benefit that can be achieved with either systems above a certain capacity level. The electrically coupled flywheel offers higher overall availability than its mechanical counterpart and forms the basis for further commercial applications for flywheel energy storage. The electrically coupled variant was therefore chosen to be tested in a scale model con-

tainer crane, and, using a suitable control system, registered not only substantial energy savings, but also consumed electrical power much more evenly, thus reducing the peak burden on the supply.

## 2506 Thermal

*REFER ALSO TO CITATION(S) 46381, 46693, 47302*

**46579 (AVESTA-PROJ—1983-5) Calculations of thermally induced stresses and dislocations by finite element method.** Stille, H.; Fredriksson, A. (Swedish State Power Board, Vaellingby). 1983. 115p. (In Swedish). NTIS (US Sales Only), PC A06/MF A01. File Number DE85752544.

Four testing cycles concerning the heating and cooling of the Avesta storage have been performed by computerized simulation, Non-stationary conditions have been attained. The largest tangential stress is about 5 MPa, which value will increase until the heat flow has been balanced. The calculated radical strain will then be about 650 micrometers at maximum. Lifting of land surface straight above the storage will be about 6mm and the dislocations of the roof and wall of the rock cavern about 2 mm.

**46580 (BFR-R—3-1985) Application of different types of heat stores in the Swedish energy system. An economic analysis.** Margen, P. (Statens Raad foer Byggnadsforskning, Stockholm (Sweden)). 1984. 79p. (In Swedish). NTIS (US Sales Only), PC A05/MF A01. File Number DE85752545.

The economy of diurnal, intermediate and seasonal heat storage is evaluated for systems where different energy forms are used for charging. Cost formulas are given for different heat stores, and profitable applications are indicated. Pay-off times of less than two years can be obtained for diurnal storage, and of two to seven years for seasonal storage in large systems. The differences between low temperature storage with heat pump discharge and high temperature storage with direct discharge, and their respective applications are discussed.

**46581 (CEA-CONF—7483) High temperature deep underground heat storage of Plaisir (France).** Despois, J. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). 1984. 11p. (CONF-8411181—1). NTIS (US Sales Only), PC A02/MF A01. File Number DE85751913.

From Colloquium on heat transfer hydrotechnique in underground applications to thermal exploitation; Paris, France (14 Nov 1984).

Underground heat storage, thermal source and utilization are linked to form a whole that should be optimized. In consequence size, storage temperature and hence site selection are chosen accordingly. For each site an optimal injection temperature is determined, in general well over 100°C. A recovery of about 60% is expected for use in district heating networks. Technological problems seem solved. A pilot heat storage coupled to a municipal waste incineration plant of 120,000 tons/year and a network of 5000 flats is being built at Plaisir near Versailles (France).

**46582 (CTH-JVG—14) Vertical pipe systems for heat storage in sand and silt. Preparatory study.** Rhen, I.; Wilen, P. (Chalmers Inst. of Tech., Goeteborg (Sweden). Earth Heat Pump Group). Jun 1984. 43p. (In Swedish). NTIS (US Sales Only), PC A03/MF A01. File Number DE85752521.

Silt and sand as well as clay is common in the urbanized areas of Sweden. At Graabo, outside Gothenburg tests have been made to put pipes into the sediments. Only 3m lowering below the land surface was managed. The cost for sand/silt is allowed to be 60% higher than for clays because of superior heat conductivity. A total cost of 80 SEK per m tube has been calculated. The future potential of placing storage systems into sand/silt has been estimated for 7 urbanized areas. If 10% of suitable area could be used for storage (depth 10m, temperature swing 10 degreeC), 0.6 TWh could be stored. This means heating supply for about 50000 apartments.

**46583 (DOE/CE/15195—T1) Apparatus for construction of large underground thermal energy storage reservoirs. Progress report.** Cleary, J.M. (Cleary (James M.), Falmouth, MA (USA)). 23 Mar 1985. Contract FG01-85CE15195. 44p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85014426.

The concept considered the construction of storage reservoirs in sand and gravel deposits by slurry trenching and block displacement. The design and plan for construction of the apparatus to be used in constructing the thermal energy storage reservoirs is presented.

**46584 (DOE/CE/15195—T2) Apparatus for construction of large underground thermal energy storage reservoirs. Second quarterly progress report.** Cleary, J.M. (Cleary (James M.), Falmouth, MA (USA)). 9 Jul 1985. Contract FG01-85CE15195. 15p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85014427.

The concept considered is the construction of storage reservoirs in sand and gravel deposits by slurry trenching and block displacement. The operation and cost estimation model of the apparatus used to construct the thermal energy storage reservoirs are presented.

**46585 (DTH-LV-MEDD—154) Seasonal heat storage in underground warm water stores. Dimensioning and planning of a full size store.** Kielsgaard Hansen, K.; Nordgaard Hansen, P.; Ussing, V. (Danmarks Tekniske Hoejskole, Lyngby. Lab. for Varmeisolering). Jul 1984. 125p. NTIS (US Sales Only), PC A06/MF A01. File Number DE85752640.

The aim of the work has been to use the experience gained in prior work to complete the design of a full size (about 50,000 $m^3$) underground warm water storage. Based on geotechnical investigations a location for the pond was chosen in the vicinity of a power plant. The site selected was filled-in from the North Sea, complicating the construction to some extent. A general study of the optimal geometry of storage ponds has been executed and the final selection of geometry and levels were undertaken. The design principle was primarily, that the water tightness should be secured by clay structures of sufficient magnitude while the chemical stability of the storage water should be secured by plastic liners of satisfactory durability. No insulation of the pond bottom or the pond walls was called for. The floating lid on the pond was insualted to an optimal extent. Drainage of the lid surface demanded varying surcharge of gravel with topsoil placed on a liner protecting the insulation from the climatic moisture. The construction of the lid has been arranged to maintain the elimination of air from the storage water. The thermal expansion of the water mass in the system is provided for through small deflections in the lid structure. The final project has been used as a base for a study of the thermal losses to be expected over a longer period of time during a constant average temperature. The final project has also formed a base for preliminary budget studies showing that large underground storages for warm water produced by uninsulated ponds with floating insulated lids may soon provide storages at prices interesting to future development of large solar energy systems.

**46586 (EUR—8681-EN) Simplified model for the technic-economic evaluation of a solar system coupled with seasonal energy storage and a heat pump.** Aranovitch, E. (Commission of the European Communities, Luxembourg. Directorate-General for Information, Market and Innovation). 1984. 59p. Commission of the European Communities, Luxembourg. Office of Official Publications of the European Communities.

A simplified technic-economic model has been proposed to assess the performance versus cost of solar systems coupled with long term storage and heat pumps. The system takes into account 26 independent variables (design parameters, weather data, cost factors) which are represented in the model by what could be defined as their first order influence. The model relies very much on the notation of "equivalent" or "effective" values of a parameter which in some cases should be obtained by an independent sub-routine. With this approach, simple analytical expressions can be derived for

the determination of the various systems and sub-systems efficiencies which can then be used as guidelines for the sizing, performance and cost evaluation of the global system. From a certain number of numerical examples based on reasonable cost factors, some rather clear indications can be put in evidence concerning both the charging and the discharging processes of solar energy from large stores. The heat pump represents a very flexible back-up system which tends to attenuate the influence of those parameters to which a solar-storage system may be sensitive such as the scale effect, temperature of utilization, minimum cycle temperature.

46587 **(LBL—19644) Monitoring of hot water plume movements in an aquifer with borehole/surface resistivity measurements.** Tsang, C.F.; Wilt, M.J. (Lawrence Berkeley Lab., CA (USA)). May 1985. Contract AC03-76SF00098. 8p. (CONF-850905—4). NTIS, PC A02/MF A01; GPO Dep. File Number DE85014531.

From ENERSTOCK '85 - international conference on energy storage for building heating and cooling; Toronto, Canada (22 Sep 1985).

In this study a simulation of a downhole/surface resistivity experiment to map a hot water plume was performed using a three-dimensional computer code. A fixed amount of hot water was placed in an aquifer between 45 and 70 m below ground surface and resistivity measurements were made at the surface using a current electrode in the hot water body. Results indicate that the anomaly is much greater using the downhole electrode than for surface arrays and that the data may be used to roughly characterize the hot water mass and its boundaries. Several cases involving different plume boundaries were studied and results indicate that the downhole/surface measurements are not very sensitive to differences in the boundary geometry although a rough determination of the boundary position is possible. For the case where the hot water plume is moving relative to the downhole current electrode until it completely leaves the electrode behind, the anomaly size is smaller but the shape allows for good discrimination of the near-side boundary.

46588 **(LBL—19645) Investigation of the vertical-flow aquifer thermal energy storage concept and numerical simulation of the Dorigny field experiment.** Doughty, C.; Tsang, C.F. (Lawrence Berkeley Lab., CA (USA)). May 1985. Contract AC03-76SF00098. 10p. (CONF-850905—3). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85014524.

From ENERSTOCK '85 - international conference on energy storage for building heating and cooling; Toronto, Canada (22 Sep 1985).

A mathematical modeling study of the vertical-flow aquifer thermal energy storage concept is made. A history match calculation of the Dorigny field experiment, part of the SPEOS project, is carried out using two simplified models. Then the main heat-loss mechanisms are isolated to study their relative importance. Finally, variations on the Dorigny experimental configuration are studied to examine the behavior of the vertical-flow storage system in general.

46589 **(PNL—5507) Underground Energy Storage Program. 1984 annual summary.** Kannberg, L.D. (Pacific Northwest Labs., Richland, WA (USA)). Jun 1985. Contract AC06-76RL01830. 46p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85014851.

Underground Energy Storage (UES) Program activities during the period from April 1984 through March 1985 are briefly described. Primary activities in seasonal thermal energy storage (STES) involved field testing of high-temperature [>100°C (212°F)] aquifer thermal energy storage (ATES) at St. Paul, laboratory studies of geochemical issues associated with high-temperatures ATES, monitoring of chill ATES facilities in Tuscaloosa, and STES linked with solar energy collection. The scope of international activities in STES is briefly discussed.

46590 **(UCRL—92832) Permeability of Ironton-Galesville sandstone at elevated temperature and pressure.** Blair, S.C. (Lawrence Livermore National Lab., CA (USA)). 19 Jun 1985. Contract W-7405-ENG-48. 7p. (CONF-850905—2). NTIS, PC A02/MF A01; GPO Dep. File Number DE85014175.

From ENERSTOCK '85 - international conference on energy storage for building heating and cooling; Toronto, Canada (22 Sep 1985).

A series of permeability tests have been conducted at elevated temperatures and pressure on samples of Ironton-Galesville sandstone. These tests were in support of the Aquifer Thermal Energy Storage (ATES) site in St. Paul, Minnesota, operated by the Department of Energy. Laboratory tests at conditions representative of those imposed by an ATES facility on storage aquifers are important, as they can assist in identifying harmful processes that may be occurring in an aquifer. This paper reports permeability of core samples to two different fluids with time at temperatures of 25, 90, 125, and 150°C. Results indicate that on the time scale of days, the flow of heated groundwater, at flow rates equivalent to those in the near-well region, can cause extensive dissolution of cementing agents and loss of mechanical strength in the sandstone cores. The data also indicate that during heating of the core, permeability is reduced by pore throat blockage accompanying the liberation of fine particles. These results indicate that operation of the ATES facility at St. Paul may be changing the fabric of the host aquifer; however, results of short-term storage tests indicate there has been no significant impact on the hydrologic performance of the aquifer.

46591 **Composite materials for thermal energy storage.** Benson, D.K.; Burrows, R.W.; Shinton, Y.D. (to Dept. of Energy). US Patent Application 6-688,668. 4 Jan 1985. 40p. Contract AC02-83CH10093. DE85017743 NTIS, PC A03/MF A01; GPO Dep. File Number DE85017743.

A composite material for thermal energy storage based upon polyhydric alcohols, such as pentaerythritol, trimethylol ethane (also known as pentaglycerine), neopentyl glycol and related compounds including trimethylol propane, monoaminopentaerythritol, diamino-pentaerythritol and tris(hydroxymethyl)acetic acid, separately or in combinations, which provide reversible heat storage through crystalline phase transformations. These PCM's do not become liquid during use and are in contact with at least one material selected from the group consisting of metals, carbon, siliceous, plastic, cellulosic, natural fiber, artificial fiber, concrete, gypsum, porous rock, and mixtures thereof. Particulate additions such as aluminum or graphite powders, as well as metal and carbon fibers can also be incorporated therein. Particulate and/or fibrous additions can be introduced into molten phase change materials which can then be cast into various shapes. After the phase change materials have solidified, the additions will remain dispersed throughout the matrix of the cast solid. The polyol is in contact with at least one material selected from the group consisting of metals, carbon, siliceous, plastic, cellulosic, natural fiber, artificial fiber, concrete, gypsum, and mixtures thereof.

## 2508 Chemical

46592 **(DOE/NASA/12726—25) Cycling performance of the iron-chromium redox energy storage system.** Gahn, R.F.; Hagedorn, N.H.; Johnson, J.A. (National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center). 1985. Contract AI04-80AL12726. 17p. (NASA-TM—87034; CONF-850808—17). NTIS, PC A02/MF A01; GPO Dep. File Number DE85013034.

From 20. intersociety energy conversion engineering conference; Miami Beach, FL, USA (18 Aug 1985).

Extended charge-discharge cycling of this electrochemical storage system at 65°C was performed on 14.5 $cm^2$ single cells and a four cell, 867 $cm^2$, bipolar stack. Both the anolyte and catholyte reactant fluids contained 1 molar concentrations of iron and chromium chlorides in hydrochloric acid and were separated by a low-selectivity, cation-exchange membrane. The effect of cycling on the chromium electrode and the membrane was determined. Bismuth and bismuth-lead catalyzed chromium electrodes and a radiation-grafted polyethylene membrane were evaluated by cycling between 5 and 85% state-of-charge at 80 $mA/cm^2$ and by periodic charge-discharge polarization measurements to 140 $mA/cm^2$. Gradual performance losses were observed during cycling but were recoverable by completely discharging the system. Good scale-up to the 867 $cm^2$ stack was achieved. The only difference appeared to be an

unexplained resistive-type loss which resulted in a 75% W-hr efficiency (at 80 mA/cm$^2$) versus 81% for the 14.5 cm$^2$ cell. A new rebalance cell was developed to maintain reactant ionic balance. The cell successfully reduced ferric ions in the iron reactant stream to ferrous ions while chloride ions were oxidized to chlorine gas.

## 2509 Batteries

**46593 (LBL—19490) Effect of flow obstacles on mass transfer to planar electrodes.** Fischl, D.S.; Muller, R.H.; Tobias, C.W. (Lawrence Berkeley Lab., CA (USA)). May 1985. Contract AC03-76SF00098. 28p. (CONF-850542—6). NTIS, PC A03/MF A01; GPO Dep. File Number DE85014545.

From 167. Electrochemical Society meeting; Toronto, Ontario, Canada (12 May 1985).

Mass transfer enhancement by rectangular rod shaped nonconducting obstacles attached to a planar electrode was investigated in a flow cell of 5 x 5 mm cross-section and 508 mm length, in the range of $80 < Re < 3200$. Effectiveness was evaluated for three different rod heights (0.25 to 1.6 mm) as a function of obstacle spacing by measuring both the pressure drop and the limiting current for the reduction of ferri-cyanide. Recirculation flow patterns were visualized by a hydrogen bubble stream generated upstream from an obstacle. In the laminar flow regime, up to fourfold increase of mass transfer rate was obtained with a power demand for pumping that was as little as one-hundredth of that required for achieving the same transport rate in the unobstructed channel. Optimally spaced flow obstacles not only greatly enhance transport rates, they also prevent the progressive increase in mass transfer boundary layer thickness in the direction of flow.

**46594 (NP—5901842) Storage battery market: profiles and trade opportunities.** Stonfer, D. (International Trade Administration, Washington, DC (USA). Nonferrous Metals Div.). Apr 1985. 55p. NTIS, PC A04/MF A01. File Number DE85901842.

The export market for domestically produced storage batteries is a modest one, typically averaging 6 to 7% of domestic industry shipments. Exports in 1984 totalled about $167 million. Canada and Mexico were the largest export markets for US storage batteries in 1984, accounting for slightly more than half of the total. The United Kingdom, Saudi Arabia, and the Netherlands round out the top five export markets. Combined, these five markets accounted for two-thirds of all US exports of storage batteries in 1984. On a regional basis, the North American (Canada), Central American, and European markets accounted for three-quarters of total storage battery exports. Lead-acid batteries accounted for 42% of total battery exports. Battery parts followed lead-acid batteries with a 29% share. Nicad batteries accounted for 16% of the total while other batteries accounted for 13%.

**46595 (PNL—5448) Status of the DOE Battery and Electrochemical Technology Program V.** Roberts, R. (Roberts Consultants, Inc., Chevy Chase, MD (USA)). Jun 1985. Contract AC06-76RL01830. 182p. NTIS, PC A09/MF A01; GPO Dep. File Number DE85015241.

The program consists of two activities, Technology Base Research (TBR) managed by the Lawrence Berkeley Laboratory (LBL) and Exploratory Technology Development and Testing (EDT) managed by the Sandia National Laboratories (SNL). The status of the Battery Energy Storage Test (BEST) Facility is presented, including the status of the batteries to be tested. ECS program contributions to the advancement of the lead-acid battery and specific examples of technology transfer from this program are given. The advances during the period December 1982 to June 1984 in the characterization and performance of the lead-acid, iron/nickel-oxide, iron/air, aluminum/air, zinc/bromide, zinc/ferricyanide, and sodium/sulfur batteries and in fuel cells for transport are summarized. Novel techniques and the application of established techniques to the study of electrode processes, especially the electrode/electrolyte interface, are described. Research with the potential of leading to improved ceramic electrolytes and positive electrode container and current-collectors for the sodium/sulfur battery is presented. Advances in the electrocatalysis of the oxygen (air) electrode and the relationship of these advances to the iron/air and aluminum/air batteries and to the fuel cell are noted. The quest for new battery couples and battery materials is reviewed. New developments in the modeling of electrochemical cell and electrode performance with the approaches to test these models are reported.

**46596 (RISO-M—2489) Synthesis and characterization of solid electrolytes.** Andersen, N.H.; Kjems, J.K.; Poulsen, F.W. (Risoe National Lab., Roskilde (Denmark)). May 1985. 293p. (In Danish). NTIS (US Sales Only), PC A13/MF A01. File Number DE85752647.

The emphasis of this project has been on basic research in the rapidly growing field of solid electrolytes. Studies were focused on 60 different lithium, sodium, potassium and fluorine ion conductors. Materials with technological interest, model compounds, and new systems were studied with neutron scattering,impedance measurements and DSC. The project has resulted in the i) identification of new crystalstructures, which favor ion transport; ii) forwarding of models for a better discription of structural and dynamical properties of solid electrolytes; iii) improvements in measuring/handling techniques. All published results are given in this volume.

**46597 (SAND—83-2270) Characterization of DEB powders and pellets for CA/$CaCrO_4$ thermal batteries.** Guidotti, R.A.; Reinhardt, F.W. (Sandia National Labs., Albuquerque, NM (USA)). Jul 1985. Contract AC04-76DP00789. 51p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85017250.

A detailed characterization study was conducted of catholyte or depolarizer-electrolyte-binder (DEB) mixes used in Ca/$CaCrO_4$ thermal batteries. A number of the physical and chemical properties of powders and pellets of the DEB mixes were examined for correlation to electrochemical performance in 5-cell and, to a lesser extent, single-cell batteries. Powder characteristics evaluated included: chemical composition, segregation, flowability, bulk density, and BET surface area. Pellet characteristics evaluated included: break strength, forming force, electrolyte leakage at 400°C after 0.5 h, and deformation at 530°C under an applied pressure of 71 kPa (10.3 psi). Three series of DEB mixes were formulated at constant D/E weight ratios of 0.50, 0.64, and 0.80 to study the effect of $SiO_2$ binder at concentrations of 8 to 12 wt%. Three additional series of DEB mixes were formulated at constant E/B weight ratios of 4.5, 5.5, and 6.5 to study the effect of $CaCrO_4$ depolarizer at concentrations of 30 to 40 wt%. The BET surface area and chemical composition of DEB powders, and the electrolyte leakage and deformation of DEB pellets, could be correlated to the activated lives and pulse characteristics of the 5-cell batteries built with these mixes.

**46598 (SAND—85-7197C) Raman and far ir spectroscopic study of quaternary ammonium polybromide fused salt phases for zinc bromine circulating electrolyte batteries.** Larrabee, J.A.; Graf, K.R.; Grimes, P.G. (Exxon Research and Engineering Co., Annandale, NJ (USA). Analytical Div.; Exxon Research and Engineering Co., Annandale, NJ (USA). Corporate Research-Advancement and Transfer Div.). 1985. Contract AC04-76DP00789. 8p. (CONF-851048—3). NTIS, PC A02. File Number DE85011711.

From 168. meeting of the Electrochemical Society; Las Vegas, NV, USA (13 Oct 1985).

The circulating electrolyte zinc bromine battery is an attractive advanced battery system. The electrolyte is a solution of zinc bromide, quaternary ammonium bromides for bromine complexation and added salts to enhance properties. Laser Raman spectroscopy and far infrared spectroscopy were used to characterize the liquid quaternary ammonium polybromide fused salt phases.

**46599 (SAND—85-7216C) Circulating electrolyte zinc/bromine battery test program and procedures.** Grimes, P. (Exxon Research and Engineering Co., Linden, NJ (USA)). 1985. Contract AC04-76DP00789. 10p. (CONF-851074—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85016996.

From International battery testing workshop; Heidelberg, F.R. Germany (1 Oct 1985).

The Exxon circulating electrolyte zinc/bromine battery system is being co-developed by organizations in America, Europe, Japan, and Australia. The circulating electrolyte zinc/bromine battery systems have reached the multi-kilowatt hour capacity size ranges. Several 20-kWh and 30-kWh systems have been successfully tested in different modes of operation. Circulating eletrolyte batteries use a test program procedure which considers the circulation system characteristics, in addition to the classical test procedures.

46600 **Hermetically sealed electrical feedthrough for high temperature secondary cells.** Knoedler, R.; Battles, J. E.; Nelson, P. A.; Shimotake, H. (to The United States of America as represented by the United States Department of Energy). US Patent 4,508,797. 2 Apr 1985. Filed date 26 Jul 1983. vp.

PAT-APPL-517473.

A passthrough seal is disclosed for electrically isolating the terminal in a lithium/metal sulfide cell from the structural cell housing. The seal has spaced upper and lower insulator rings fitted snuggly between the terminal and an annularly disposed upstanding wall, and outwardly of a powdered insulator also confined between the upstanding wall and terminal. The adjacent surfaces of the upper insulator ring and the respective upstanding wall and terminal are conically tapered, diverging in the axial direction away from the cell interior, and a sealing ring is located between each pair of the adjacent surfaces. The components are sized so that upon appropriate movement of the upper insulator ring toward the lower insulator ring the powdered insulator and sealing rings are each compressed to a high degree. This compacts the powdered insulator thereby rendering the same highly impervious and moreover fuses the sealing rings to and between the adjacent surfaces. The upper and lower insulator rings might be formed of beryllium oxide and/or alumina, the powdered insulator might be formed of boron nitride, and the sealing rings might be formed of aluminum.

46601 **Chromium (V) compounds as cathode material in electrochemical power sources.** Delnick, F. M.; Guidotti, R. A.; McCarthy, D. K. (to The United States of America as represented by the United States Department of Energy). US Patent 4,508,796. 2 Apr 1985. Filed date 21 Apr 1983. vp.

PAT-APPL-487492.

A cathode for use in a thermal battery, comprising a chromium (V) compound. The preferred materials for this use are $Ca_3(CrO_4)_2Cp$, $Ca_5(CrO_4)_3OH$, and $Cr_2O_5$. The chromium (V) compound can be employed as a cathode material in ambient temperature batteries when blended with a suitably conductive filler, preferably carbon black.

# 29 ENERGY PLANNING AND POLICY

46602 **(DOE/NBM—5017505) Analysis of the impacts of the President's tax proposal on major sectors of the energy industry.** (USDOE Energy Information Administration, Washington, DC). Aug 1985. 128p. NTIS, PC A07/MF A01 - GPO; GPO Dep. File Number DE85017505.

Purpose of this study is to assess the impact of the President's tax proposal on the energy sector. The study consists of two parts. The first part reported in this document, specifically addresses the impacts of the President's tax proposal on the oil and gas, coal, and electric utility sectors of the energy industry. Impacts were examined at both the project and corporate levels. The study focuses on proposed changes in corporate income taxation.

46603 **(NP—5770365) Spain - energy situation 1983/84.** (Bundesstelle fuer Aussenhandelsinformation, Koeln (Germany, F.R.)). Mar 1985. 55p. (In German). NTIS (US Sales Only), PC A04/MF A01. File Number DE85770365.

The energy situation of Spain is reviewed on the basis of relevant data. Some remarks on the country's national and international energy policy are followed by a detailed description of trends in energy sources and electric power generation. Important figures are presented on external trade and the balance of payments.

46604 **(UCID—20296) Protection of Industrial Capability Program pre-decision support. Final report.** Hickman, R. (Lawrence Livermore National Lab., CA (USA)). Nov 1984. Contract W-7405-ENG-48. 16p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85018048.

We exmined the structures and practices of industry in general and of a few individual industries within the United States. This examination was performed to increase the necessary data base such that prudent decisions can be made in developing a program to protect our nation's industrial capability. We recognized vast interdependencies among industries and found these interdependencies to be worldwide in scope. International aspects of industrial protection were considered. Choke points in our industrial economy were sought and identified. We found that present risk-management methods were suboptimal and often off-focus when viewed from an emergency preparedness planner's perspective. We developed a systematic method to help emergency preparedness planners determine the most cost-effective combination of steps various industries could take to mitigate the effects of various threats, especially terrorist attacks or war. Finally, our analysis addressed industrial-recovery capabilities and emphasized vulnerability reduction.

## 2902 Economics And Sociology

*REFER ALSO TO CITATION(S) 46062, 46078, 46224, 46615, 46616, 46617, 46618, 46621*

46605 **(DOE/IR/10295—T3) Two-year college contributions to energy education.** Mahoney, J.R. (American Association of Community and Junior Colleges, Washington, DC. Energy Communications Center). Jul 1981. Contract FG05-79IR10295. 12p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85016967.

46606 **(DOE/IR/10295—T4) Community colleges: focus on energy. Final report.** (National Council for Resource Development, Washington, DC (USA)). Sep 1980. Contract FG05-79IR10295. 30p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85016966.

To develop and disseminate resource materials on potential sources of funds for energy-related educational activities the community college decision makers, the following tasks were implemented: analysis of existing energy-related resource information in both the public and private sectors; compilation and publication of funding information into an energy resource guide; dissemination of funding information to the field through presentations at selected state, regional, and national workshops sponsored by the Council; analysis of energy related projects in the field that was supported by external funding sources; preparation of a publication that highlights energy-related projects in the field, and planning for educational programming; and dissemination to community colleges, public and private sector program resources, and other interested agencies of both the Energy Resource Guide and the Profiles in Energy publications.

46607 **(DOE/IR/10295—T5) Energy-related activities in community, junior, and technical colleges: a directory.** Duncan, S.T.; Mahoney, J.R. (comps.). (American Association of Community and Junior Colleges, Washington, DC. Energy Communications Center). May 1981. Contract FG05-79IR10295. 736p. NTIS, PC A99/MF A01; 1; GPO Dep. File Number DE85016968.

There are approximately 1230 two-year colleges in the US. The data in this Directory show that 823 of them (67%) offer either some form of energy instruction or have implemented energy conservation strategies in an effort to reduce energy costs. These 823 institutions offer 1425 discrete programs.

46608 **(DOE/TIC—4636-Rev.1) Directory of State Energy Programs. Revision 1.** Jared, M.W. (ed.). (USDOE Office of Scientific and Technical Information, Oak Ridge, TN). Jun 1985. 286p. NTIS, PC A13/MF A01; GPO Dep. File Number DE85003233.

This Directory is a 1984 update of state information programs. It is a guide to 650 information components of state energy offices, state extension services, and economic and community development programs. Arrangement is alphabetical by state. Where applicable, individual offices are listed hierarchically. Indexes for state organizations, personnel names, and program services are included. The information contained in this directory is also available on-line on DOE/RECON, a computer retrieval system maintained by the Department of Energy, Office of Scientific and Technical Information. The EIRI file is updated biweekly with the following information: (1) DOE information centers, libraries, programs, and operations offices; national laboratories; state energy offices and extension services and their programs; territorial and trust energy offices, extension services and their programs; and information sources within DOE contractor organizations are included. Where applicable, economic and community development programs are listed. Several other federally funded programs that supply energy-related information of significant value are provided. (2) Existing data bases, on-line retrieval systems, serial publications, newsletters, hot lines, facsimile transmission devices, interlibrary loan services, and restrictions on usage of the source as an information contact are included. (3) EIRI identifies an organization's key information personnel, from the director to a specific contact person. FTS and commercial telephone numbers are provided.

46609 **Energy economics and foreign policy in the Soviet Union.** Hewett, E.A. Washington, DC; Brookings Institute (1984). 241p. (DOE/PE/70267—T47). The Brookings Inst., 1775 Mass. Ave., NW, Washington, DC 20036. File Number TI85016745. Contract AC01-80PE70267.

Prospects for the Soviet energy sector as a whole are analyzed over the rest of the decade. The focus is on energy supplies, energy demand and on energy balances available for energy trade. The author concludes that the Soviet Union is likely to remain a net exporter for energy throughout the 1980s.

## 2903 Environment, Health, And Safety

*REFER ALSO TO CITATION(S) 46023, 46079, 46214, 47301, 47431, 47435*

46610 **(NP—5770360) Environmental policy with pollutant interactions.** Endres, A. (Technische Univ. Berlin (Germany, F.R.). Wirtschaftswissenschaftliche Dokumentation). 1984. 42p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85770360.

The possibilities to meet an interactive pollutant constraint at minimum cost have been considered. Effluent charges, transferable discharge permits and the command and control strategy have been used to represent the environmental policy options. It turned out that effluent charges are efficient in the case of linear pollutant interaction. The environmental policy constraint is met in an iterative process not more complicated than in the case of no pollutant interaction, as analyzed traditionally in the literature.

## 2905 Research, Development, Demonstration, And Commercialization

*REFER ALSO TO CITATION(S) 45980, 46002, 46315, 46619, 46620, 46631, 47278*

## 2906 Nuclear Energy

*REFER ALSO TO CITATION(S) 47194*

46611 **(UE/C-ANL—810930-Vol.1) Fourth update of the Energy Economic Data Base (EEDB) Program. Phase IV, Final report. Volume I.** Allen, R.E.; Brown, P.E.; Kaminski, R.S.; Smith, M.H.; Ziegler, E.J. (United Engineers and Constructors, Inc., Philadelphia, PA (USA)). Sep 1981. Contract W-31-109-ENG-38. 424p. (COO—6411-1-Vol.1). NTIS, PC A18/MF A01; 1; GPO Dep. File Number DE85016735.

EEDB deals with the development of cost data for nuclear and comparison electric power plants. Its objective is to provide periodic updates of technical and cost (capital, fuel and operating and maintenance) information for use in evaluating and monitoring US civilian nuclear power programs. It contains six nuclear power plant technical models and five comparison coal-fired fossil power plant technical models. (DLC)

## 2910 Conservation

*REFER ALSO TO CITATION(S) 46064, 46674, 46701*

## 2920 Supply, Demand, And Forecasting

*REFER ALSO TO CITATION(S) 46077*

46612 **(ORNL/TM—9671) Navy Mobility Fuels Forecasting System. Phase I report.** Davis, R.M.; Hadder, G.R.; Singh, S.P.N.; Whittle, C. (Oak Ridge National Lab., TN (USA)). Jul 1985. Contract AC05-84OR21400. 98p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE85017848.

The Department of the Navy (DON) requires an improved capability to forecast mobility fuel availability and quality. The changing patterns in fuel availability and quality are important in planning the Navy's Mobility Fuels R and D Program. These changes come about primarily because of the decline in the quality of crude oil entering world markets as well as the shifts in refinery capabilities domestically and worldwide. The DON requested ORNL's assistance in assembling and testing a methodology for forecasting mobility fuel trends. ORNL reviewed and analyzed domestic and world oil reserve estimates, production and price trends, and recent refinery trends. Three publicly available models developed by the Department of Energy were selected as the basis of the Navy Mobility Fuels Forecasting System. The system was used to analyze the availability and quality of jet fuel (JP-5) that could be produced on the West Coast of the United States under an illustrative business-as-usual and a world oil disruption scenario in 1990. Various strategies were investigated for replacing the lost JP-5 production. This exercise, which was strictly a test case for the forecasting system, suggested that full recovery of lost fuel production could be achieved by relaxing the smoke point specifications or by increasing the refiners' gate price for the jet fuel. A more complete analysis of military mobility fuel trends is currently under way.

## 2930 Policy, Legislation, And Regulation

*REFER ALSO TO CITATION(S) 46073, 46214, 46608, 46609*

46613 **(EFN—6) Municipal energy planning. An evaluation of the public support to research, development and demonstration.** (Energiforskningsnaemnden, Stockholm (Sweden)). Apr 1984. 78p. (In Swedish). NTIS (US Sales Only), PC A05/MF A01. File Number DE85752508.

The paper includes the following studies: - survey and analysis of research, development and demonstration which has been performed by means of public financial support - survey of future needs of research and development - evaluation of assorted projects. Recommendations for future activities are presented. A more stringent scrutiny of the results prior to publication is required.

46614 **(EFN—9) Program or venture. Views on the evaluation of energy research.** (Energiforskningsnaemnden, Stockholm (Sweden)). Jun 1984. 123p. (In Swedish). NTIS (US Sales Only), PC A06/MF A01. File Number DE85752510.

From 1975 to 1984 energy research has been granted 2600 MSEK by the parliament. The evaluation of the program can be considered as a political tool. So various types of evaluation are discussed. In order to use specific language, a number of interviews with different project leaders are presented. The paper is dealing with the discussion on the power and information concerning the actions of authorities.

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46615 **Energy security in the 1980s: economic and political perspectives.** Bohi, D.R.; Quandt, W.B. Washington, DC; The Brookings Institution (1984). 59p. (DOE/PE/70267—T39). The Brookings Institution, 1775 Massachusetts Ave., NW, Washington, DC 20036. File Number TI85016746. Contract AC01-80PE70267.

This study emphasizes that the energy security problem of the 1980s will differ significantly from that of the 1970s. Lessons from the past are not always a good guide to the future. The authors do not, however, suggest that the energy problem is behind us and that markets alone can be left to work their magic. Diplomacy, military preparedness, and public policy still have a role in reducing the risks of future energy crises and in dealing with the consequences of oil-supply disruptions.

## 2940 Fossil Fuels

*REFER ALSO TO CITATION(S) 45980, 46002, 46023, 46060, 46060, 46061, 46061, 46062, 46062, 46071, 46073, 46077, 46078, 46079, 47431*

46616 **(DOE/EI/19683—T1) [Survey on No. 2 home heating oil]. Final report.** (New York Energy Office, Albany (USA)). 21 May 1985. Contract FG01-84EI19683. 4p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85017664.

This report contains a brief summary of a survey on No. 2 home heating oils conducted in New York State. The survey period included the 1983-1984 and 1984-1985 heating seasons. Both price and stockpile information are discussed. 2 figs. (DMC)

46617 **(DOE/EI/19686—T1) Overview of Massachusetts distribution system.** (Massachusetts Executive Office of Energy Resources, Boston (USA)). [1985]. Contract FG01-84EI19686. 21p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85017571.

The results of a program to collect and monitor retail and wholesale prices and inventory levels of No. 2 home heating oil in Massachusetts from October 1984 through May 1985 are reported. Survey methods are described and the results are analyzed including implications of international events. 5 figs., 6 tabs.

46618 **(DOE/EI/19692—T1) Weekly monitoring program for retail prices, wholesale prices and bulk terminal stocks of No. 2 fuel oil in the State of New Jersey.** (New Jersey Dept. of Energy, Newark (USA)). 1985. Contract FG01-84EI19692. 6p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85017663.

This report contains a brief summary of the results of surveys conducted in New Jersey to monitor the retail and wholesale prices and bulk terminal stacks of No. 2 heating oil in the state from October 1, 1984 to May 1, 1985. Methods for data collection and reporting and analysis of survey design are described.

46619 **(DOE/PC/60408—T3) Second annual workshop on biomass and coal conversion programs of the USAID/GOI Alternative Energy Resources Development Project. Trip report to India, January 24-February 8, 1985.** (Viking Energy Corp., Pittsburgh, PA (USA)). 1985. Contract AC22-83PC60408. 48p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85017293.

Highlights of the technical discussions presented at the workshop and the site visits are included in this report. The intent of the Workshop was to review the progress of the program during the past year; to encourage US specialists to discuss with their Indian counterparts the direction and future of the program; to assess the status of the individual projects through site visits to the facilities and address any concerns or anticipated problems in meeting the objectives of each of the coilaborative projects; and to provide a forum for technical exchange between US and Indian industry to understand the need for and availability of technology, products and services in the US and India in specific areas of interest in coal and biomass conversion. There are six projects which have been selected for collaboration in coal conversion and three in biomass conversion. The six coal projects are: evaluation of freeboard performance in a fluidized-bed combustor; AFBC boiler scaleup; hot gas cleanup; cold gas cleanup; rheology; stability, and combustion of coal/water mixtures; and coal beneficiation. The 3 major biomass projects are: development of a village-level gasifier (5 HP) for irrigation pumps based on charred agricultural residue; utilization of producer gas in small (3 to 5 HP) utility engines; and development and field implementation of small wood-based gasifier engine systems (5 to 30 HP).

46620 **(DOE/PC/60408—T4) Biomass and coal conversion projects of the USAID/GOI Alternative Energy Resources and Development Program. Semiannual report.** (Viking Energy Corp., Pittsburgh, PA (USA)). Jun 1984. Contract AC22-83PC60408. 54p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85017292.

The US Agency for International Development (AID), in joint collaboration with the Government of India (GOI), is supporting the development of alternative energy resources with primary emphasis on the utilization of coal and biomass as feedstock. This report describes the work performed to-date, the current status of the program, and includes an appendix that provides summary descriptions of the individual projects and future schedules. There are four areas of interest in coal conversion. They include fluidized-bed combustion, coal beneficiation, coal-water mixtures, and gas cleanup and separation. There are 3 areas of interest in biomass conversion. They include development of a village-level gasifier (5 hp) for irrigation pumps based on agricultured residue. Utilization of producer gas in small (3 to 5 hp) engines, and development and field testing of a small, wood-based, gasifier-engine system. 9 tabs.

46621 **(NP—5752664) Contribution to the analysis of short-term macroeconomic effects of energy-price shocks in open economies. Part 1-2.** Bo Nielsen, S. (Copenhagen Univ. (Denmark). Oekonomisk Inst.). 1984. vp. (In Danish). Copenhagen Univ. (Denmark). Oekonomisk Inst.

The purpose of this dissertation is to integrate imported energy goods into short-term macroeconomic theory for open economies and, in particular, to analyze the macroeconomic consequences of a price shock on such goods in an economy such as Denmark's. Theoretical models of the impact of an energy price shock in large economic regions and in smaller, open economies are constructed and analyzed. The study also includes a survey of the economic literature on this subject and a discussion of the international adjustment to the oil price hikes in 1973/74 and 1979/80.

## 2960 Electric Power

*REFER ALSO TO CITATION(S) 46577, 46611*

46622 **(DOE/EIA—0348(84)) Electric Power Annual, 1984.** (USDOE Energy Information Administration, Washington, DC. Office of Coal, Nuclear, Electric and Alternate Fuels). 1984. 159p. NTIS, PC A08/MF A01 - GPO; GPO Dep. File Number DE85017935.

As a result of the continued economic recovery that occurred in the United States in 1984, electric utilities generated 2,416,304 gigawatthours (GWh) of electricity, an increase of 4.6% from 1983. Over a 5-year period, total net generation averaged a 1.4% increase per year. Electricity generation from coal-fired units set an all-time record in 1984, producing 1,341,681 GWh, accounting for the largest share of net generation among all fuels, 55.5%. For this same period, nuclear power replaced hydroelectric power as the second-most important fuel in the generation of electricity, 13.6% of total net generation. Hydroelectric power and generation from gas-fired units contributed 13.3% and 12.3%, respectively. Petroleum's share of net generation continued to decrease as it accounted for 5.0% of net generation in 1984. Net generation from other sources (wood, wind, waste, solar, and geothermal) accounted for 0.4% of total generation during 1984.

46623 **(DOE/EIA—0476) Analysis of growth in electricity demand, 1980-1984.** Cornett, C.M. (USDOE Energy Information Administration, Washington, DC. Office of Energy Markets and End Use). 11 Sep 1985. 49p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85018010.

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This report examines recent trends in the demand for electricity. Between 1980 and 1984, the average growth in electricity was considerably lower than growth in the real gross national product (GNP); while in all years prior to 1976, electricity demand increased more rapidly than GNP. In order to examine the significance of this change in recent years, a review of historical trends in electricity demand is presented, followed by a discussion of regional and sectoral trends in electricity demand. This detailed examination yields information about possible future trends in the demand for electricity.

46624 **(EPRI-EA—4206) Commercial and industrial response to time-of-use rates: methodology and case studies. Final report.** Miedema, A.K.; Stern, K.M. (Research Triangle Inst., Research Triangle Park, NC (USA)). Aug 1985. 312p. Research Reports Center, Box 50490, Palo Alto, CA, 94303. File Number TI85920863.

A methodology using economic-engineering analyses provides a framework for predicting the response of utility customers in the industrial and commercial sectors to time-of-use rates. A computer code incorporating three case studies is expected to be available for use later this year.

46625 **(NP—5752660) Danish electricity supply. Statistics 1984.** (Danske Elvaerkers Forening, Copenhagen). May 1985. 47p. (In Danish). NTIS (US Sales Only), PC A03/MF A01. File Number DE85752660.

With an English summary. Published yearly.

The Danish Association of Electricity Supply Undertakings each year issues the statistical yearbook 'Danish Electricity Supply'. By the means of brief text, figures, and tables a description is given of the electric supply sector. The topics, that are treated, are production and consumption of electric power, production of heat, fuel consumption, the power plants and transmission system, and economy and prices of electric power. Each year a specific topic is treated in a supplementary article.

46626 **(STEV-TFS—84-8) Modelling of electric power systems - a description and comparison of ten power system models.** Karlsson, S. (Statens Energiverk, Stockholm (Sweden)). Oct 1984. 112p. (In Swedish). NTIS (US Sales Only), PC A06/MF A01. File Number DE85752520.

This report describes and compares ten computer models which may be used for analysis of the Swedish electricity system. Eight of the models are technical models and represent the electricity production system with different categories of power plants. Six of these are pure production models and use a given electricity load curve. The other two are modelling more or less the whole energy system, not only different energy carriers but also different technologies for energy use. The last two model are general equilibrium models describing the whole economy of the society. Here the electricity system is just a small part of the production and consumption in the society. The technical models are compared with respect to their ability to represent different qualities of the electricity system. For the Swedish electricity system, where hydro power is a substantial part, it is very important to consider different constraints on the production possibilities to obtain correct results. The general equilibrium models are analyzed with respect to thin mechanisms for changing the electricity system over time. Finally the applicability of the ten models for analysis of different issues is discussed.

## 2980 Consumption And Utilization

46627 **(DOE/EIA—0035(85/05)) Monthly Energy Review, May 1985.** (USDOE Energy Information Administration, Washington, DC. Office of Energy Markets and End Use). Aug 1985. 128p. NTIS, PC A07/MF A01; 1 - GPO; GPO Dep. File Number DE85017236.

Current data on US production, consumption, stocks, imports, exports, and prices of principal energy commodities are reported for each month of 1984 through the most recent month of 1985, and for each year from 1973 through 1984. Quarterly summaries for the current year are also provided. Energy sources covered are crude oil, petroleum products, natural gas, coal, nuclear power, and electric utilities. Also reported are energy consumption by sector, selected energy indicators, and oil and gas resource development. For selected other countries in the world, production, consumption, and stocks of petroleum and electricity generation by nuclear power plants are presented. Conversion factors and a glossary are provided, along with feature articles on current energy topics.

46628 **(EFN-AES—1984-2) Variations in the energy productivity within industry branches.** Bogren, E. (Energiforskningsnaemnden, Stockholm (Sweden)). Oct 1984. 53p. (In Swedish). NTIS (US Sales Only), PC A04/MF A01. File Number DE85752555.

This report presents background material to a study on the future energy demand of industry. Differences in energy consumption within industries have been studied using a computer system for analysis of industrial statistics, SindData. A negative correlation was found between the energy consumption and the degree of processing (expressed as processing value/employee). The processing value and the energy consumption are given in diagrams for 19 different industries.

46629 **(NP—5752529) International residential energy statistics. Compilation of data from eight countries.** Wickman, R. (Statens Inst. foer Byggnadsforskning, Gaevle (Sweden)). Jan 1984. 187p. NTIS (US Sales Only), PC A09/MF A01. File Number DE85752529.

As part of the Consumer Energy Conservation Policies (CECP) project eight country teams have submitted national energy data of several kinds. Data from Australia was received after the first compilation, which explains its separate presentation. The report has been reviewed by the national teams. Data from some recent publications (especially conerning data for U.S.A.) has been added. The report is planned to be published by the CECP-project during 1984. The statistical material presented in this report is based on the eight national reports. Two additional sources have been used: 1) The Growth of Energy Consumption and Prices in the USA, FRG, France and the UK, 1950-1980, by Claire P. Doblin, (IIASA 1982), and 2) An Efficient Energy Future, (United Nations, Economic Commission for Europe, 1983). For some countries we have calculated per capita figures using aggregate energy data and population or household figures found in official data sources. The data on prices and costs have been converted to German Marks. Because of the rather large fluctuations of the currencies during the 1970's, this may sometimes give results that are surprising - even misleading. As the reader may understand from the problems mentioned above the data should be used with caution. Sometimes the data presented are fragile and the comparability may be weak.

46630 **(NP—5770364) Iran - energy situation 1984.** (Bundesstelle fuer Aussenhandelsinformation, Koeln (Germany, F.R.)). May 1985. 10p. (In German). NTIS (US Sales Only), PC A02/MF A01. File Number DE85770364.

The contribution of petroleum, natural gas, coal, nuclear power and electricity to energy supply in Iran is reviewed. Few data are presented.

## 2990 Unconventional Sources And Power Generation

*REFER ALSO TO CITATION(S) 46260, 46315, 46385, 46619, 46620*

46631 **(DOE/OR/21389—6) Northeast Regional Biomass Program. Quarterly report, October-December 1984.** (CONEG Policy Research Center, Inc., Washington, DC (USA)). 1984. Contract FG05-83OR21389. 23p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85017987.

Highlights of progress are summarized for the second year of the Northeast Regional Biomass Program. The report covers the period from October 1 through December 31, 1984. The objective of the program is to promote the responsible use of biomass energy by the public and private sectors in the 11-state Northeast region. During this quarter, first year grant agreements expired and new ones were negotiated with 9 of the 11 states. The two remaining grant agreements will be negotiated in the next quarter. In several states, work that was not completed under the first year program will be carried over to the second year. Draft final reports have

been received from all of the first year contractors. Final revisions and editing are currently being performed in anticipation of publishing these reports in the next quarter. A request for proposals in three technical areas was mailed out in October, 1984 and 14 proposals were received. Contractor selections have been made for the following projects: Targeted Industrial Conversion; The Impact of Large Biomass Demand Centers on the Resource Base; and The Economic Impact of Wood Energy Use in the Northeast. In addition, a small contract was awarded to the Northeast States for Coordinated Air Use Management (NESCAUM) for preparation of a guide to state air quality regulations affecting industrial woodburning in the region. State grant summaries are included in this report.

# 30 DIRECT ENERGY CONVERSION

## 3001 Mhd Generators

**46632 (DOE/PC/70509—T3) Magnetohydrodynamic power generation. Final report, March 9, 1984-March 8, 1985.** Kruger, C.H.; Eustis, R.H.; Mitchner, M.; Self, S.A.; Nakamura, T. (Stanford Univ., CA (USA). High Temperature Gasdynamics Lab.). Jun 1985. Contract AC22-84PC70509. 151p. NTIS, PC A08/MF A01; GPO Dep. File Number DE85016429.

Experimental and theoretical research has been conducted to investigate phenomena expected to be important in the development of MHD power generation. The areas investigated were: Boundary layers and generator loss mechanisms, plasma nonuniformities and instabilities, investigation of rod electrodes, seed-slag interaction and the reactivity of coal, disk generators, and temperature diagnostic techniques for combustion MHD plasmas. Brief summaries of the principal results and their expected impact for large scale MHD generators are given: (1) Secondary flows driven by transverse Lorentz forces are predicted to be a major phenomenon in large-scale generators. We have studied this phenomenon by conducting experiments in a laboratory-scale facility in which a high magnetic interaction parameter for driving such secondary flows has been achieved by applying axial current and by maintaining low flow rates. The results of measurements of transverse velocities show that the resulting secondary flows consist of intense, large-scale vortices which convectively distort the cross-plane distribution of important plasma properties. (2) An experimental approach based on measurements of the phase difference of acoustic waves excited in an MHD generator has been successfully employed to detect changes caused by the magnetoacoustic interaction. Predictions for large-scale MHD generators, based upon this same theory, suggest that the possible detrimental effects of the magnetoacoustic interaction cannot be ignored, and must be given serious attention in the design of large-scale facilities.

**46633 Thermoacoustic magnetohydrodynamic electrical generator.** Wheatley, J.C.; Swift, G.W.; Migliori, A. (to Dept. of Energy). US Patent Application 6-672,228. 16 Nov 1984. 15p. Contract W-7405-ENG-36. DE85017768 NTIS, PC A02/MF A01; GPO Dep. File Number DE85017768.

A thermoacoustic magnetohydrodynamic electrical generator includes an intrinsically irreversible thermoacoustic heat engine coupled to a magnetohydrodynamic electrical generator. The heat engine includes an electrically conductive liquid metal as the working fluid and includes two heat exchange and thermoacoustic structure assemblies which drive the liquid in a push-pull arrangement to cause the liquid metal to oscillate at a resonant acoustic frequency on the order of 1000 Hz. The engine is positioned in the field of a magnet and is oriented such that the liquid metal oscillates in a direction orthogonal to the field of the magnet, whereby an alternating electrical potential is generated in the liquid metal. Low-loss, low-inductance electrical conductors electrically connected to opposite sides of the liquid metal conduct an output signal to a transformer adapted to convert the low-voltage, high-current output signal to a more usable higher voltage, lower current signal.

## 3004 Thermionic Converters

**46634 Solid oxide fuel cell having compound cross flow gas patterns.** Fraioli, A. V. (to The United States of America as represented by the Department of Energy). US Patent 4,510,212. 9 Apr 1985. Filed date 12 Oct 1983. vp.
PAT-APPL-541176.

A core construction for a fuel cell is disclosed having both parallel and cross flow passageways for the fuel and the oxidant gases. Each core passageway is defined by electrolyte and interconnect walls. Each electrolyte wall consists of cathode and anode materials sandwiching an electrolyte material. Each interconnect wall is formed as a sheet of inert support material having therein spaced small plugs of interconnect material, where cathode and anode materials are formed as layers on opposite sides of each sheet and are electrically connected together by the interconnect material plugs. Each interconnect wall in a wavy shape is connected along spaced generally parallel line-like contact areas between corresponding spaced pairs of generally parallel electrolyte walls, operable to define one tier of generally parallel flow passageways for the fuel and oxidant gases. Alternate tiers are arranged to have the passageways disposed normal to one another. Solid mechanical connection of the interconnect walls of adjacent tiers to the opposite sides of the common electrolyte wall therebetween is only at spaced point-like contact areas, 90 where the previously mentioned line-like contact areas cross one another.

## 3005 Fuel Cells

*REFER ALSO TO CITATION(S) 46595*

**46635 (CONF-850836—5) Application of fuel cells to chlorine-caustic technology.** Gelb, A.; Garman, A.; Bloomfield, D. (Physical Sciences, Inc., Andover, MA (USA)). 1985. Contract FC07-84ID12495. 31p. (PSI—530/SR-217). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85014622.

From American Institute of Chemical Engineers national meeting; Seattle, WA, USA (25 Aug 1985).

The results of a systems analysis investigation of the application of fuel cell technology to the chlorine-caustic electrolytic industry are presented. A coupled electrolytic/alkaline fuel cell system designed to concentrate caustic and generate electricity shows large potential energy savings (30 to 50% reductions) and rapid return on investment.

**46636 (DOE/ET/12227—T1) Investigation of solid electrolyte materials for fast carbon-ion transport for application in fuel cells of novel design.** Cocks, F.H.; Locher, J.W. (Duke Univ., Durham, NC (USA). Dept. of Mechanical Engineering and Materials Science). Dec 1980. Contract FG01-78ET12227. 22p. NTIS, PC A02. File Number DE85017609.

If a solid electrolyte material with low electronic conductivity but high carbon ion conductivity could be developed it would make possible coal-based fuel cells that are entirely new in concept. Previously, using $ZrO_2$ in which oxygen ions show high mobility, considerable effort has already been directed at producing high temperature fuel cells but no equivalent attempt based on carbon-ion transport has apparently ever been made. It is known that carbon does indeed exist as an ion not only in compounds but also even when dissolved in metals, such as iron. No one, however, appears to have considered the possibility of developing a solid electrolyte material with high carbon-ion mobility but low electronic conductivity. In such a carbon-ion fuel cell, unlike those based on oxygen-ion transport through zirconia, all normal coal combustion processes would be eliminated and the direct electrochemical oxidation of coal, dissolved in a solvent, e.g., iron, to $CO_2$ would be possible. Such a fuel cell concept is, of course, critically dependent on the development of materials with low electronic conductivity but high ionic conductivity for carbon-ions. Although there is experimental proof that carbon exists in ionic form, not only in compounds but also in metals, no attempts appear ever to have been made at determining the transference numbers of such carbon ions.

A review of possible candidate carbon-ion solid eletrolyte materials shows that doping of ionic carbides might be expected to produce materials with high carbon-ion mobilities. The work described here examined the possibility of carbon ion transport in salt-like carbides to assess the use of such materials as ionic-membrane solid electrolyte materials in carbon-ion fuel cells. 13 refs.

**46637 (DOE/MC/20094—1729) Trace contaminant removal from hot coal gas for molten carbonate fuel cell application. Quarterly technical progress report No. 4, July-September 1984.** Patel, P.S. (Energy Research Corp., Danbury, CT (USA) ). 1984. Contract AC21-83MC20094. 36p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85005660.

The evaluation of different regeneration conditions was continued in conjunction with the preliminary sulfur adsorption screening. Most of the sorbents tested appeared to be approximately 60 to 100% regenerable in 70% $H_2O$/30% $H_2$ at 700°C. Further investigation with other regeneration atmospheres, such as air and/or steam and operating temperature, is in progress. A literature investigation was performed to evaluate the effects of carbon deposition on nickel catalysts. In the study of carbon deposition effects, the reactions such as Boudouard, water gas shift, and methanation may play an important role. The thermodynamic considerations indicate that carbon deposition may be avoided by adding sufficient steam or carbon dioxide to the model coal gas, which is predicted to be carbon depositing. The arsenic adsorption capacity and rate study was initiated this quarter. Preliminary sorption studies with a nickel-molybdenum catalyst, Sorbent 106 appear to indicate an adsorption capacity in excess of 90,000 ppmw As. This capacity is much greater than its sulfur adsorption capacity and may be indicative of bulk reactions between nickel and arsenic. Work has begun in the sorption/regeneration reactor process design study. A preliminary cost evaluation is being performed based on sorbent performance, manufacturer's price and raw material cost. This evaluation is expected to aid in the sorbent selection. 8 refs., 7 figs., 1 tab.

**46638 Fuel cell stack with internal manifolds for reactant gases.** Schnacke, A. W. (to The United States of America as represented by the Department of Energy). US Patent 4,510,213. 9 Apr 1985. Filed date 12 Oct 1983. vp.

PAT-APPL-541185.

A fuel cell stack includes a plurality of plate-like fuel cells arranged along an axis generally parallel to cell thickness with electrically conductive separator plates between each pair of cells. A plurality of axial manifolds are provided at opposite sides of the stack in outer marginal portions beyond the edges of electrodes and electrolyte tiles. Sealing rings prevent cross-leakage of oxidant fuel gases through use of pairs of outwardly extending lips from opposite tile surfaces bonded to first and second electrode frames respectively. The frames provide transition between electrode edges and manifold perimeters. The pairs of extension lips are sealingly bonded together through an electrically insulative sealing ring with wedge shaped fastening members.

**46639 Steam-Methane Reformer Kinetic Computer Model with Heat Transfer and Geometry Options.** Murray, A.P.; Snyder, T.S. (Westinghouse R&D Center, Pittsburgh, Pennsylvania). *Industrial and Engineering Chemistry Process Design and Development;* 24: No. 2, 286-294(Apr 1985).

A kinetic computer model of a steam/methane reformer has been developed as a design and analytical tool for a fuel cell system's fuel conditioner. This model has reaction, geometry, flow arrangement, and heat transfer options. Model predictions have been compared to previous experimental data, and close agreement was obtained. Initially, the Leva-type, packed-bed, heat transfer correlations were used. However, calculations based upon the reacting, reformer gases indicate a considerably higher heat transfer coefficient for this reforme design. Data analysis from similar designs in the literature also shows this phenomenon. This is thought to be reaction-induced effect, brought about by the changing of gas composition, the increased gas velocity, the lower catalyst temperature during reaction, and the higher thermal and reaction gradients involved in compact fuel cell reformer designs. Future experimental work is planned to verify the model's predictions further.

# 32 ENERGY CONSERVATION, CONSUMPTION, AND UTILIZATION

**46640 (CONF-851002—1) Heat pump strategy at the Nevada Test Site.** Davis, R.E. (Holmes and Narver, Inc., Mercury, NV (USA)). 1985. Contract AC08-76NV00020. 4p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85013669.

From 8. world energy engineering congress; Atlanta, GA, USA (22 Oct 1985).

The high desert location of the Nevada Test Site (NTS) provides both high and low temperature extremes during the course of a year. The remoteness of the NTS resulted in the selection of electricity as the principal energy source for environmental conditioning systems. These two factors have led the facility designers at the NTS to select the technology of heat pumps as the principal means of providing air conditioning for new facilities. This paper discusses the installations of heat pumps at the NTS over the past five years. Air-to-air heat pumps installed at the NTS include split systems, single package systems, and through-the-wall systems. A large central plant closed cycle water-to-air heat pump system is also described. The results of a recent analysis of an open cycle water source heat pump system are also presented.

**46641 (LBL—19174) Radiative heat pumps using narrow-bandgap semiconductors.** Berdahl, P. (Lawrence Berkeley Lab., CA (USA)). Aug 1985. Contract AC03-76SF00098. 12p. (CONF-850887—34). NTIS, PC A02/MF A01; GPO Dep. File Number DE85017654.

From SPIE international technical symposium on optical and electro-optical engineers; San Diego, CA, USA (18 Aug 1985).

The Solid State Radiative Heat Pump (SSRHP) concept is introduced. It offers the potential to pump infrared radiation - for heating and cooling - with high second law efficiency. In particular, some of the limitations of Peltier-effect heat pumps can be circumvented. Two approaches for constructing SSRHP devices will be described. In one approach the device is a large-area p-n junction, similar to an ir (light) emitting diode. In the second approach one uses orthogonal electric and magnetic fields to alter equilibrium carrier concentrations of electrons and holes near the crystal surface, altering the ir emission due to electron-hole recombination radiation. This phenomenon is usually termed galvanomagnetic luminescence (GML). Either approach can be used to make radiative heat pumps. Materials suitable for SSRHP devices are narrow-bandgap semiconductors with direct bandgaps in the range of 0.03 to 0.3 eV for room temperature operatin. Obvious candidates are InSb, Hg/sub 1-x/Cd/sub x/Te, and Pb/sub 1-x/Sn/sub x/Te. As a first step in the evaluation of InSb, our laboratory has made absolute spectral measurements of its galvanomagnetic luminescence. These and related measurements in Russia and Japan are discussed.

## 3201 Buildings

*REFER ALSO TO CITATION(S) 46323, 46353, 46357, 46358, 46363, 46371, 46586, 46751, 46912, 46944, 46975*

**46642 (BFR-R—31-1984) Low energy houses - present state and need for research.** Johannessen, G. (Statens Raad foer Byggnadsforskning, Stockholm (Sweden)). 1984. 84p. (In Swedish). NTIS (US Sales Only), PC A05/MF A01. File Number DE85752527.

This report tries to define the basic goal and means for attaining the best energy saving methods and components for building low energy singel and multiple houses. Based on 59 projects so far initiated the present state in this field is described and the need for further research defined. Selected literature between 1978 - 83, all in Swedish, and the views of a reference group are evaluated. The pitfalls in collecting data with the help of forms are discussed and improvements suggested since the response from project leaders in Scandinavia was poor, incorrect or incomplete.

46643 **(CONF-850606—15) Comparisons of four computer models with experimental data from test buildings in northern New Mexico.** Robertson, D.K.; Christian, J.E. (New Mexico Univ., Albuquerque (USA). New Mexico Energy Research and Development Inst.; Oak Ridge National Lab., TN (USA)). 1985. Contract AC05-84OR21400. 23p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85016376.

From American Society of Heating, Refrigerating and Air-Conditioning Engineers' semiannual meeting; Honolulu, HI, USA (23 Jun 1985).

Eight one-room test buildings, 20 ft (6.1 m) square and 7.5 ft (2.3 m) high, were constructed on a high desert site near Tesuque Pueblo, New Mexico, to study the influence of wall dynamic heat transfer characteristics on building heating requirements (the "thermal mass effect"). The buildings are nominally identical except for the walls (adobe, concrete and masonry unit, wood-frame, and log) and are constructed so as to isolate the effects of the walls. The amount of mass in the walls varies from 240 lb/ft$^2$ (1171 kg/m$^2$) for the 2 ft (.61 m) thick adobe wall to 4.3 lb/ft$^2$ (21 kg/m$^2$) for the insulated wood-frame wall. The roof, floor, and stem walls are all well insulated and the buildings were constructed with infiltration rates less than 0.4 air change per hour. The site is instrumented to record building component temperatures and heat fluxes, outside weather conditions, and heating energy use. Data were collected for two heating seasons from midwinter to late spring with the buildings in two configurations, with and without windows. Four computer codes were used to simulate the performance of the test buildings without windows, using site weather data. The codes used were DOE-2.1A, DOE-2.1C, BLAST, and DEROB. Each code was run by a different analyst. Simulations were done for midwinter, late winter, and spring. Two of the test cell comparisons are discussed; the insulated frame and an 11-in. (.28 m) adobe. This work presents a quantitative and qualitative critical comparison of the modeling and experimental results. Cumulative heating loads, wall heat fluxes, and air surface temperatures are compared, as well as input assumptions to the models. Explanations of differences and difficulties encountered are reported. The principal findings were that cumulative heating loads and the characteristic influences of wall thermal mass on hourly behavior were reproduced by the models.

46644 **(CONF-850782—1) Approach to developing an audit for combined building shell and heating system retrofits.** McCold, L.N. (Oak Ridge National Lab., TN (USA)). 1985. Contract AC05-84OR21400. 24p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016354.

From National weatherization conference; Portland, OR, USA (15 Jul 1985).

With the recent expansion of the Weatherization Assistance Program to include retrofits for space heating equipment, the problem of selecting retrofits for each treated house has become more complicated. This paper shows that the savings from some retrofits are highly variable from one house to another. An audit approach is presented which ranks the retrofits by their benefits-to-cost ratio. While a general audit will give correct savings estimates and rankings for retrofits in a wide range of locations, its use will be more burdensome than necessary in any particular locale. Three steps are outlined which can be used to simplify the audit without significantly reducing its accuracy: ignore interactions between retrofits, incorporate local climate and fuel price information, and eliminate retrofits which seldom or never rank high enough to be used. Installing all retrofits with B/C ratios greater than some locally determined minimum value is suggested as an alternative to spending the same amount of money on each house. A method for selecting the minimum B/C ratio is described. Examples illustrating these points are included.

46645 **(CONF-850808—18) Comparative study of water, ice and clathrates for cool storage applications.** Carbajo, J.J. (Oak Ridge National Lab., TN (USA)). 1985. Contract AC05-84OR21400. 7p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85016313.

From 20. intersociety energy conversion engineering conference; Miami Beach, FL, USA (18 Aug 1985).

Cool storage systems are needed in order to reduce the large summer peak loads of many electric utilities in the United States. Cool storage systems will use off-peak electricity during the summer night and will provide air conditioning during the day requiring very little on-peak electricity. This paper describes different cool storage systems and compares the following storage media: water, ice, Refrigerant-11 clathrate, Refrigerant-12 clathrate, Refrigerant-21 clathrate, and mixed clathrates of Refrigerant-11 and Refrigerant-12. Direct- and indirect-charged as well as direct- and indirect-discharged systems are also compared. Hybrid systems (latent and sensible heat) including ice and water, clathrate and liquid, and clathrate and liquid and salts (to reduce the freezing temperature) are also studied. It is concluded that the most appealing system, from the technical and economical point of view, is a system using mixed clathrate, liquid and salt.

46646 **(CONF-851002—2) Off peak ice storage generation.** Davis, R.E.; Cerbo, F.J. (Holmes and Narver, Inc., Mercury, NV (USA)). 1985. Contract AC08-76NV00020. 4p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85013668.

From 8. world energy engineering congress; Atlanta, GA, USA (22 Oct 1985).

Due to the high costs associated with peak demand charges imposed by most electrical companies today, various means of shifting the peak HVAC load have been identified by the industry. This paper discusses the results of a study based upon a building site located in the high desert of the southwestern United States that evaluated ice storage as a mechanism of operating cost reductions. The discussion addresses both the seasonal and the annual cost and energy impacts of an ice storage system when used in place of an air-to-air heat pump system.

46647 **(CONF-8409266—1) Moisture measurements in buildings.** Courville, G.; TenWolde, A. (Oak Ridge National Lab., TN (USA); Forest Products Lab., Madison, WI (USA)). 1984. Contract AC05-84OR21400. 12p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85017098.

From BTECC moisture workshop; Washington, DC, USA (25 Sep 1984).

The need for measurement of in-situ moisture content in building-envelope components is discussed. Electric resistance techniques are most common. They are relatively inexpensive and their use is straightforward. However, calibration is very difficult and penetration into the system being tested is required. Two non-intrusive techniques, electrostatic capacitance and nuclear magnetic resonance, are currently being studied in the laboratory to assess their usefulness as quantitative tools. 21 refs., 8 figs.

46648 **(CONF-8504174—1) Vapor compression heat pump system field tests at the TECH complex.** Baxter, V.D. (Oak Ridge National Lab., TN (USA)). 1985. Contract AC05-84OR21400. 32p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85016364.

From Energy sources: conservation and renewables; Washington, DC, USA (27 Apr 1985).

The Tennessee Energy Conservation In Housing (TECH) complex has been utilized since 1977 as a field test site for several novel and conventional heat pump systems for space conditioning and water heating. Systems tested include the Annual Cycle Energy System (ACES), solar assisted heat pumps (SAHP) both parallel and series, two conventional air-to-air heat pumps, an air-to-air heat pump with desuperheater water heater, and horizontal coil and multiple shallow vertical coil ground-coupled heat pumps (GCHP). A direct comparison of the measured annual performance of the test systems was not possible. However, a cursory examination revealed that the ACES had the best performance, however, its high cost makes it unlikely that it will achieve widespread use. Costs for the SAHP systems are similar to those of the ACES but their performance is not as good. Integration of water heating and space conditioning functions with a desuperheater yielded significant efficiency improvement at modest cost. The GCHP systems performed much better for heating than for cooling and may well be the most efficient alternative for residences in cold climates. 27 refs., 12 figs., 9 tabs.

**46649 (CONF-8508111—1) Use of detailed evaluation data to develop a low cost monitoring system: the BPA residential weatherization program.** Hirst, E.; Tonn, B. (Oak Ridge National Lab., TN (USA)). 1985. Contract AC05-84OR21400. 12p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016477.

From National conference on energy program evaluation; Chicago, IL, USA (19 Aug 1985).

The purpose of this is to develop a low-cost and simple monitoring/evaluation plan for the Bonneville Power Administration (BPA) long-term Residential Weatherization Progam (RWP). The need for an inexpensive and timely way to estimate program energy savings springs from problems inherent in traditional evaluations. Careful outcomes evaluations of conservation programs are expensive and time consuming; two or more years may elapse between the time of evaluation attention and the time final results are available. Perhaps, the detailed data available from such evaluations can be used to develop a reliable analytical system to monitor future performance of the same program. These thoughts led to this study of RWP. 12 refs.

**46650 (CONF-8508111—2) Evaluation of a financial incentive program: the BPA residential weatherization program.** Hirst, E.; Goeltz, R.; Keating, K. (Oak Ridge National Lab., TN (USA); USDOE Bonneville Power Administration, Portland, OR). 1985. Contract AC05-84OR21400. 12p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016478.

From National conference on energy program evaluation; Chicago, IL, USA (19 Aug 1985).

During 1982 and 1983, the Bonneville Power Administration (BPA) operated an interim Residential Weatherization Program (RWP) throughout the Pacific Northwest. Participating households received free home energy audits and financial assistance to help pay for installation of retrofit measures in their homes. Almost 104 thousand homes were retrofit during the two years that the progam operated; BPA's program cost totaled almost $160 million. This paper summarizes the results of a comprehensive evaluation of the BPA program. The evaluation focused on the energy-saving effects of the program and on its economic costs and benefits. Under a wide range of assumptions the program is economically attractive to the participants and to the region as a whole. However, the program may not be economically beneficial to the BPA power system (i.e. near-term electricity price increases exceed long-term price decreases). In other words, the program is likely to lower overall costs of energy services to the region, but it may yield higher electricity prices. The negative findings for the BPA power system are a direct consequence of BPA's forecast of future marginal costs and wholesale prices. The BPA forecasts show marginal costs below wholesale prices until 1994; thus any program that reduces electricity consumption during this time will increase electricity rates.

**46651 (DOE/CS/20485—T1) Documentation of the lending process.** Chase, S.H.; Manion, J.S.; Garcia-Hohmann, J. (Andrulis Research Corp., Bethesda, MD (USA)). Aug 1981. Contract AC03-79CS20485. 361p. NTIS, PC A16/MF A01; 1; GPO Dep. File Number DE85017220.

US DOE has forged a partnership with the American Bankers Association, the US League of Savings Associations, and the National League of Savings and Loans to develop training materials for senior financial institution officials, loan officers and staff appraisers in the area of energy efficient considerations at the residential time of transfer. Also, training materials will be developed to enable financial institutions to educate their customers regarding residential energy efficiency. To reach this goal, the lending process must be documented to provide training material developers with an understanding of possible areas where the lending process can be most effected by energy education. Objective of this report was to document the mortgage lending process by conducting a literature search. Researchers concentrated on the role of both primary lenders and the secondary mortgage market. Also, studies were made on the types of mortgage plans, linkages between major actors (e.g., real estate agents, appraisers, senior bank officials, loan officers), guarantors (e.g., FHA, VA), and mortgage variations due to region and building type and owner.

**46652 (DOE/OR/21400—T175) Hearing on the future of RCS and CACS.** Hirst, E. (Oak Ridge National Lab., TN (USA)). 5 Sep 1985. Contract AC05-84OR21400. 5p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85017976.

The Oak Ridge National Laboratory has been involved with the RCS (Residential Conservation Service) and CACS (Commercial and Apartment Conservation Service) programs since 1979. ORNL's activities include technical support to DOE on rulemaking; technical assistance to DOE, states, and utilities in development and implementation of state plans; evaluation of the actual performance of selected programs; and technical research related to energy audits and performance of individual retrofit measures. This long history of involvement with the program provides a valuable basis for the present statement. The following points cover important issues associated with performance of existing RCS programs and alternatives to improve the program.

**46653 (DTH-LV-MEDD—152) 6 low-energy houses at Hjortekaer. Technical installations - results from specific test series.** Rasmussen, N.H.; Saxhof, B. (Danmarks Tekniske Hoejskole, Lyngby. Lab. for Varmeisolering). Jun 1984. 95p. (In Danish). NTIS (US Sales Only), PC A05/MF A01. File Number DE85752633.

EFP.

As part of the Danish Energy Research and Development Programme six prototype low-energy houses have been built at Hjortekaer, north of Copenhagen, as detached single-family houses eash having a living area of approx 120 m². Five houses were completed in the autumn of 1978 and the last one in March 1979. This report describes a series of specific tests carried out in situ in the six low-energy houses. The test programme includes measurement of heat loss (stand-by losses etc) from hot water tanks and boilers, and from circulation systems, measurement of domestic hot water supply temperature at forced tapping, measurement of the ability of the hot water systems (capacity and speed of hot water production) and measurement of the electricity consumption for technical installations in the hot water systems and heating systems. As quite a few technical solutions have been applied in the six houses the analyses cover as different items as storage tanks for active solar systems, an air-to-air heat pump, air-to-water heat pumps, a water-to-water heat pump, a grey waste water heat recovery system, an oil burner and a gas burner and a few other topics. The performance and the energy consumption of the different heating systems and hot water systems have been analyzed at typical summer and winter conditions for selected fortnights.

**46654 (EUR—8949-EN) Performance monitoring of solar heating systems in dwellings 1982-1983.** Ferraro, R.; Godoy, R. (Commission of the European Communities, Luxembourg. Directorate-General for Information, Market and Innovation). 1984. 99p. Commission of the European Communities, Luxembourg. Office of Official Publications of the European Communities.

The Performance Monitoring Group has been undertaking a series of Performance Optimisation Studies with a view to illustrating methods by which solar heating systems can be optimised to achieve higher energy savings per unit capital cost of the system. The Performance Optimisation Studies have been carried out by making local extensions to the existing PMG structure, whilst at the same time other more traditional PMG work has continued to be undertaken by the original Group. The studies have resulted in designs, produced under realistic practical constraints, which show improvements in cost effectiveness by a factor of 1.5 to 2.5 with respect to most projects studied previously by the PMG in its project data collection exercises. In addition, the PMG has continued to collect and analyse system performance data from monitored solar buildings in Europe, concentrating on innovative systems and systems with improved performance. Pilot test projects are recommended to establish if the energy savings predicted in the design studies can be achieved in practice at the costs specified. User response and system reliability can be assessed only through practical experience.

46655 **(EUR—9132-EN) OPTIMO - a method for assessing the energy saving potential in public-property buildings.** Graziani, G.; Paruccini, M.; Zanantoni, C. (Commission of the European Communities, Luxembourg. Directorate-General for Information, Market and Innovation). 1984. 67p. Commission of the European Communities, Luxembourg. Office of Official Publications of the European Communities.

This paper describes a method for minimizing the overall payback time of a series of energy-conservation measures, that can be employed on the existing building stock of a region or a country. The method can be used for only a fraction of the building stock: the dwellings for which the decision on conservation measures can be taken, by a single economic actor, over a large number of buildings; typically the State-owned buildings. The method is based on the hypothesis that: - the decision-maker intends to allocate his capital to and conservation measures in such a way as to minimise the overall payback time, - due to the large number of dwellings, the cost reductions due to contemporary application of more than one measure are negligeable. This means that the dwellings can be considered as split up into the structural elements (walls, windows, ...) to which the various conservation measures can be applied.

46656 **(EUR—9237-EN) Air distribution methods for domestic warm air heating systems using low grade heat sources. Tests with low level and high level air supply terminals.** Awbi, H.B.; Savin, S.J. (Commission of the European Communities, Luxembourg. Directorate-General for Information, Market and Innovation). 1984. 229p. Commission of the European Communities, Luxembourg. Office of Official Publications of the European Communities.

A warm air system that utilises low-grade energy as its primary source will be required to deliver much higher air change rates than a conventional system which uses high-grade energy. The object of this investigation was to identify the limits of air change rate and supply temperature within which a warm air system operating with a low-grade energy source could still provide comfortable conditions in a typical living room of a low-energy house.

46657 **(EUR—9445-EN) Influence of lubricating oil on heat pump performance.** McMullan, J.T.; Hughes, D.W.; Morgan, R. (Commission of the European Communities, Luxembourg. Directorate-General for Information, Market and Innovation). 1984. 202p. Commission of the European Communities, Luxembourg. Office of Official Publications of the European Communities.

A microprocessor based data logging and control system for the detailed examination of heat pump performance is described and some preliminary results are discussed of its application to the complex problem of determining the influence of lubricating oil on system performance. Results are presented which illustrate the powerful data analysis software which has been developed, and the relationship between data collection and analysis is demonstrated. A systematic investigation of the influence of oil on heat pump performance is presented for a limited range of operating conditions, and conclusion are drawn about the impact that oil is having on the system and the measures that must be taken to counteract its deleterious effects. A theoretical analysis of the thermodynamic properties of pure refrigerants and refrigerant-oil mixtures is given and is applied in the analysis of the experimental data. Pressure - enthalpy charts are presented for pure refrigerant 12 and for a mixture of R12 with a typical oil.

46658 **(EUR—9537-EN) Energy saving from optimum design and control of lighting in office buildings.** (Commission of the European Communities, Luxembourg. Directorate-General for Information, Market and Innovation). 1985. 206p. Commission of the European Communities, Luxembourg.

A demonstration project confirmed with energy-saving lighting systems has been carried out in an office building of the N.V. Nederlande Gasunie in Groningen. A total of five systems, each on a different floor of the building, were tested under comparable conditions. The building consists mainly of small office rooms. The energy consumption of each system was measured over a period of about one year. In addition, an appreciation investigation was carried out. The lighting systems were controlled in such a way as to make use of daylight entering the building. The systems differ from each other in their installed powers, the use or not of artificial lighting control and in their type (background and work station lighting). All the regulated systems showed a significant reduction in the number of burning hours (30-40% of the maximum of 2600 burning hours) compared with a lighting system having no regulation based on daylight level.

46659 **(EUR—9817-EN) Investigation into a complete earth-to-water heat pump system in a single-family dwelling focusing on the application of a vertical subsoil heat exchanger.** Bouma, J.W.J.; Koppenol, A.D.; Horst, J.F. van der. (Commission of the European Communities, Luxembourg. Directorate-General for Information, Market and Innovation). 1985. 255p. Commission of the European Communities, Luxembourg. Office of Official Publications of the European Communities.

Vertical subsoil heat exchangers for heat pumps have been studied to establish the state of the art. The heat exchangers most frequently used are of the concentric-tube and to a less extent of the parallel-tube type. A review is given of the techniques of making holes in the earth to accommodate the heat exchanger tubes and installing them. With the purpose of designing the subsoil heat exchanger the finite-element simulation model has been used to handle the characteristic features of the system, comprising heat exchanger, residence, heat pump and climate. Computer simulations have been performed for seven tubes with lengths of 10 m, 15 m and 20 m respectively. The system comprises an electrical heat pump and a floor heating/radiator system. Comparison of calculated and measured data shows satisfactory agreement for the complete system. The research study shows that vertical earth heat pump systems can be applied successfully for the heating of private residences, although especially in The Netherlands, the present natural gas boilers are economically more attractive than these heat pump systems. Directives are given regarding the design and application of vertical subsoil heat exchangers. Working diagrams are presented that give information on heat extraction, pipe temperature, COP and single-tube length for different soils. Furthermore a cost indication is given of installation work and complete practical installations while guidelines are presented for the lay-out of the network.

46660 **(EUR—9859-EN) Study of new building materials with high thermal diffusivity devoted to heat storage.** Solaini, G.; Tonelli, A.M. (Commission of the European Communities, Luxembourg. Directorate-General for Information, Market and Innovation). 1985. 17p. Commission of the European Communities, Luxembourg. Office of Official Publications of the European Communities.

New building materials with high transverse thermal diffusivity have been conceived and proposed, with the aim of increasing the amount of heat which can be stored in the buildings' walls. The proposed building structures consist in combinations of materials characterized by differentiated thermal properties. In buildings' perimetral walls external insulation is required. Heat can be supplied to the walls by radiation or convection; in this last case, warm air must be supplied by means of heating elements disposed along the wall's basis. This system allows to reduce the demand of energy and to improve physiological comfort, by means of a better distribution of the room temperature, of a better radiative exchange among walls and persons, and of a lower operating plant temperature. The research is concerned with the study of the thermal behaviour of the proposed structures, by means of theoretical and experimental investigations. A theoretical model and a computer programme have been developed in order to obtain the temperature distribution inside the walls and the amount of stored heat for different geometrical distributions of the conducting elements. Experimental investigations have been carried out on several heat storing walls, charged by solar radiation or by convection, and discharged by convection, making use of different materials, and with different distributions of the thermal conductors. Numerical and experimental data have been compared and discussed. Finally, economical

and energetic evaluations have been carried out, concerning the proposed structures.

46661 **(IVA—275) Domestic fuels in small combustion plants.** (Royal Swedish Academy of Engineering Sciences, Stockholm). Oct 1984. 130p. (In Swedish). (CONF-8406272—). NTIS (US Sales Only), PC A07/MF A01. File Number DE85752543.

From Symposium on domestic fuels in small combustion plants; Stockholm, Sweden (6 Jun 1984).

This is a report making an attempt to answer the following questions regarding the efficiency interval of 100 kW to MW: - How must the fuels be prepared to meet combustion requirements - Which requirements can be raised concerning combustion when solid fuels are used - What is the market outlook for small solid-fuels burning combustion plants. This report contains the lectures held at a symposium arranged on June 6, 1984, by the Royal Swedish Academy of Engineering Sciences (IVA). Sweden's Government and the Swedish Riksdag have decided that the oil dependence be reduced, and, consequently, interest in using alternate fuels has increased. Domestic fuels have thus become attractive also for use in small combustion units. Though solid fuels burning technology has been well-known for a long time, requirements are tightened up for environment protection, higher efficiency, and decreased personnel resources. Great development achievements are underway both when it comes to combustion and to preparation of fuels technology. Still, there is the crucial question of how small solid-fuels burning units are to tackle competition from Sweden's low-price electricity and disconnectable electric furnaces.

46662 **(LBL—19778) Life of fluorescent lamps operated at high frequencies with solid-state ballasts.** Verderber, R.R.; Morse, O.; Rubinstein, F.M. (Lawrence Berkeley Lab., CA (USA)). Jul 1985. Contract AC03-76SF00098. 7p. (CONF-851071—4; EEB-L—85-06). NTIS, PC A02/MF A01; GPO Dep. File Number DE85017647.

From IEEE-Industry Applications Society annual meeting; Toronto, Ontario, Canada (6 Oct 1985).

Standard 40-watt, F-40, rapid-start, fluorescent lamps were operated with solid-state ballasts following the standard life-testing cycle of 3 hours on and 20 minutes off for more than 20,000 hours at high frequency. Lamp operating characteristics (starting voltage, filament voltage, arc current, and current-crest factor) were studied as factors affecting lamp life. Measurements show that fluorescent lamps can attain rated life at high frequency using solid-state ballasts. When lamps are operated in the dimmed mode, full filament power is required to sustain lamplife. The rate of lamp lumen depreciation is dependent on the lamp loading and not the operating frequency.

46663 **(LBL—19779) Effect of filament power removal on a fluorescent lamp system.** Verderber, R.R.; Morse, O.; Rubinstein, F.M. (Lawrence Berkeley Lab., CA (USA)). Jul 1985. Contract AC03-76SF00098. 7p. (CONF-851071—3; EEB-L—85-05). NTIS, PC A02/MF A01; GPO Dep. File Number DE85017648.

From IEEE-Industry Applications Society annual meeting; Toronto, Ontario, Canada (6 Oct 1985).

Two techniques are used to measure the effects of removing the filament power from a two-lamp, F-40, rapid-start fluorescent lamp system. The changes are measured for a standard CBM core-coil ballast and for a solid-state ballast operating the lamp at high frequency. There is a 4 tp 6% increase in system efficacy when the filament power is removed. Removal of filament power also decreases filament temperature from 1000°C to below 700°C in lamps operated at 60 Hz, and from above 600°C to 300°C in lamps operated at high frequency. The study shows that the arc current and anode fall also determine filament temperature.

46664 **(LBL—19818) Potential for wind induced ventilation to meet occupant comfort conditions.** Byrne, S.J.; Huang, Y.J.; Ritschard, R.L.; Foley, D.M. (Lawrence Berkeley Lab., CA (USA)). Jul 1985. Contract AC03-76SF00098. 20p. (CONF-8509126—2). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85017670.

From Hot humid climate conference; College Park, TX, USA (24 Sep 1985).

This paper describes a simple graphic tool that enables a building designer to evaluate the potential for wind induced ventilation cooling in several climate zones. Long term weather data were analyzed to determine the conditions for which available wind speed can be used to meet occupant comfort conditions. By calculating the change in enthalpy produced by a typical residential air conditioner during those hours when an occupant is uncomfortable, we were able to estimate the impact of natural ventilation on building cooling load. The graphic presentation of the results allows a designer to determine the potential energy savings of increasing the ventilation air flow rate as well as the orientation of building openings that will maximize ventilation cooling of the building occupants. 14 refs., 17 figs.

46665 **(LUTKDH/TKKA—3001-1-120) Sorption heat pumps. A literature survey.** Colschen, R. (Tekniska Hoegskolan, Lund (Sweden). Avdelningen foer Apparatteknik). 1984. 119p. (In Swedish). NTIS (US Sales Only), PC A06/MF A01. File Number DE85752532.

A comprehensive literaute study on sorption heat pumps has been carried out during 1983 at the department of Chemical Engineering I, Lund Institute of Technology. The main objective of the study is to identify relevant chemical engineering R and D projects in this area. The study shows that much theoretical and practical work has been done to improve and develop absorption heat pumps. Until now much less research work has been devoted to heat transformers which, in MW-sizes, are of great interest from a chemical engineering point of view. The following R and D projects concerning heat transformers has been identified during the study. - Systematisation of the calculation procedures for enthalpy-concentration and entropy-concentration diagrams. Measurement and data correlation of thermodynamic and physical properties of both traditional and new working pairs. - Improvement of the design of the generator and the absorber to achive more effective heat and mass transfer. - Development of computer programs for simulation of arbitrary complex systems. - Technical-economical optimisation of chemical plants in which heat transformers have been integrated.

46666 **(NEFOS—1984-3) Economic comparison of electrically driven compressor heat pumps with absorption heat pumps.** Lundqvist, D.; Sandberg, E. (Naeringslivets Stiftelse foer Forskning och Utveckling inom Energiomraadet, Stockholm (Sweden)). Jun 1984. 44p. (In Swedish). NTIS (US Sales Only), PC A03/MF A01. File Number DE85752507.

The quality or the temperature of that energy which is used for the process is also critical for the possible heat factor. This means that at applicable temperatures below 250 degreeC of the operational heat of an absorption process the mechanical heat pump will produce a heat factor which is 2.5 times higher. Heat transformer will be interesting at high prices of electric power and presumes low-priced heat at high temperatures. The conclusion will be that the absorption processes cannot be economically competitive in Sweden.

46667 **(NP—5752630) Reported case studies on the profitability of thermal insulation measures in buildings.** (EURIMA, Roskilde (Denmark)). Dec 1983. 68p. NTIS (US Sales Only), PC A04/MF A01. File Number DE85752630.

EURIMA decided to collect, through its members, cases showing the profitability of thermal insulation measures in different types of buildings and in various countries, comparing calculated savings with measured savings. The present 29 cases comprise buildings from Belgium, Denmark, England, Finland, France, Germany, Netherlands Norway, Spain and Sweden - a total of 10 countries. All cases are based on buildings and measures carried out, for which no study of the energy savings had been planned beforehand. As it was important to compare calculated savings with actual and measured savings, it was necessary to exclude houses for which the energy consumption for heating, hot water etc. before improvements was not available. This has limited the number of cases very much, because hardly any house owners seem to have this information available.

**46668 (NP—5752651) Comparative tests on calves. Insulation - ventilation - heating.** Hansen, K. (Statens Jordbrugstekniske Forsoeg, Horsens (Denmark)). Oct 1984. 35p. (In Danish). NTIS (US Sales Only), PC A03/MF A01. File Number DE85752651.

Comparative tests have been carried out in 3 calf houses, of which one was insulated, mechanically ventilated and heated (KA-1), another was insulated and had an automatically regulated natural ventilation system without heating (KA-2), and the third house was not insulated and was provided with a non regulated natural ventilation system (KA-3). Bull calves of Danish Red and Danish Black and White Breeds were used in the trials. There were, however, a few hybrids of heavy races. On the basis of the test results the following can be concluded: Mechanical ventilation must be dimensioned at minimum 100 $m^3/h$ per calf. The minimum amount of air must never be less than 30 $m^3/h$ per calf. - For natural ventilation the inlet areas should be at minimum 0.04 $m^2$ per calf and the outlet areas 0.03$m^2$ per calf. In insulated houses the openings must be adjustable in order to keep the house frost-free. - The ventilation plant must be constructed in such a way that it does not give rise to draughts, i.e. the air velocity must not exceed 0.2 m per second within the calves' living area. Draught-free ventilation can be achieved by distributing the inlet area on many small openings. - Temperatures between -10sup(o)C and 30sup(o)C apparently have no significant influence on the growth and health of the calves. However, there was a tendency of a somewhat slower development of illnesses in the heated calf house. - When there is a sufficient air change, and thus a relatively low temperature, the relative humidity has no significant influence on the growth and health of the calves. - In not insulated calf houses the feed consumption in winter is 3-4% higher, than in insulated calf houses, corresponding to an 1-2 % greater annual feed consumption.

**46669 (NP—5752663) Air-conditioning measurements in six low-energy houses.** Moellehave, L.; Andersen, I.; Lundqvist, G.R. (Aarhus Univ. (Denmark). Hygiejnisk Inst.). Feb 1985. 58p. (In Danish). NTIS (US Sales Only), PC A04/MF A01. File Number DE85752663.

EM-2.

Six houses with intended low energy consumption were built in Hjortekaer at Lyngby in September 1978. The houses represented the newest knowledge on building techniques and materials. The houses made it possible to examine the indoor atmospheric environment, to be expected in future homes. The houses were unoccupied for the first year. Measurements of the indoor atmospheric environment in this period are described in this report. All the five series of measurements were conducted under normal outdoor climatic conditions. Windspeed, however, was in all cases lower than one meter per second. The indoor climate was as average characterized by an air temperature of 24.7 +/- 3.0 degC and an air humidity of 5.9 +/- 2.0 g/kg. Ventilation in each room was between 0.79 and 2.92 air changes per hour. On average 14 different compounds were identified in the samples. A total of 23 different compounds were identified, and Toluene and alpha-Pinene were the most frequent compounds. The concentration decreased systematically during the year, and was halved after, on an average, 112 days. Halflife varied from 63 to 187 days. The concentration was constant in one of the houses. The formaldehyde concentrations were measured during the first visit in all six houses and were in all cases less than 0.02 $mg/m^3$. It was concluded that the concentration of organic gases and vapours of the solvent type was similar to that earlier found in other Danish houses.

**46670 (NP—5752666) Registration of energy-related conditions in the service sector.** Mehlsen, K.; Togeby, M. (Danmarks Tekniske Hoejskole, Lyngby. Fysisk Lab. 3). May 1985. 163p. (In Danish). NTIS (US Sales Only), PC A08/MF A01. File Number DE85752666.

The report is the result of the first phase of a project on elucidating the energy consumption of the Danish service sector. A status is given of the energy conservation measures carried out on a national level in the service sector. The existing legal aspects of importance for the energy consumption of the service sector are elucidated and the effect of the Heat Control Act is evaluated. Data from the Danish national accounts on energy consumption of the service sector are analysed. Furthermore existing models and statistics of the heat consumption in the buildings of the service sector are presented and compared. Based on statistical data on buildings it was possible to give an estimate of the total consumption for space heating. Preliminary figures of the electric power consumption in the different parts of the service sector are also presented. The consumption of electric power is a very large part of the total energy consumption of the service sector. The efficiency of the heating systems are analysed together with the energy consumption for heating the ventilation air and for lighting which is also a large part of the net energy comsumption, specially in the service sector.

**46671 (NP—5901816) Study of weatherization service alternatives in Michigan. Final report.** Kushler, M.: Witte, P. (Michigan Dept. of Commerce, Lansing (USA)). Mar 1985. 62p. Energy Administration, Michigan Dept. of Commerce, Box 30228, Lansing MI 48909. File Number TI85901816.

The major results of the study are those pertaining to fuel savings. These include the following: Both the regular and reduced-cost weatherization service alternatives demonstrated significant energy savings when fuel consumption records were compared before and after service. Homes in the regular group achieved a 14.7 percent reduction in space heat fuel use ("weather adjusted"), while those in the reduced-cost group achieved a 9.2 percent reduction. Homes receiving the low-cost/no-cost service alternative demonstrated no significant change in space heat fuel use. The no-service comparison group actually experienced an increase in its space heat fuel use. The magnitude of that increase was estimated to be between 2.0 and 5.7 percent, depending on the time period examined. There was no significant difference in the amount of fuel savings per dollar of direct cost between the regular service alternative and the reduced-cost alternative. There was no significant difference in the amount of energy savings resulting from weatherization by private contractors versus agency crews. Telephone interviews showed that client reaction to the service was very positive for each of the weatherization alternatives examined. An important area for improvement that was identified was the need to emphasize client education in the area of "dialing down" heating thermostat settings, so that energy savings produced by conservation measures are not reduced or nullified by clients increasing their thermostat settings after receiving the weatherization service. This may be especially important in the low-cost/no-cost program area.

**46672 (ORNL/CON—189) Potential vs practice: installation of retrofit measures in the Hood River Conservation Project.** Hirst, E.; Goeltz, R. (Oak Ridge National Lab., TN (USA)). Sep 1985. Contract AC05-84OR21400. 53p. NTIS, PC A04/MF A01; GPO Dep. File Number DE85018141.

Although only half the eligible homes have completed the HRCP process, some conclusions can be drawn concerning penetration of retrofit measures. The following thoughts are based on the 1747 homes that had essentially completed participation in HRCP by the end of May 1985. HRCP and its extensive data collection processes yield valuable and unique information on the reasonable upper limits for a residential retrofit program in the Pacific Northwest. That is, the high level of retrofits included in the project and the substantial financial contribution from BPA minimize the importance of capital cost and existing levels of structure thermal performance, two major obstacles to retrofit in most programs. Removal of these barriers, coupled with the details provided on types and times of barriers, will greatly increase our knowledge of the practical limits of residential retrofit programs. Removal of these barriers is effective in getting recommended measures installed. Almost 90% of the measures recommended by the energy auditors were subsequently installed by the Project. These results demonstrate the feasibility of installing almost all recommended retrofit measures in a program that is well run and that pays for most of the retrofit cost. The conservation potential in existing homes is difficult to define and to determine. Different definitions are feasible depending on how one considers measures that are not applicable, that cannot be installed because of physical limitations, that are already partially or fully in place, or that households do not want installed. 14 refs.

**46673 (ORNL/Sub—83-70376/1) Survey of building envelope thermal anomalies and assessment of thermal break materials for anomaly correction. Volume I. Survey and assessment.** Silvers, J.P.; Tye, R.P.; Brownell, D.L.; Smith, S.E. (Dynatech R/D Co., Cambridge, MA (USA)). 21 Jun 1985. Contract AC05-84OR21400. 31p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85017939.

The objective of this project was to identify, study and classify information about structural thermal bridges and about new structure materials which could be used to form thermal breaks. A subtask was to report the proceeding of a National Bureau of Standards Federal Workshop on Thermal Bridges and Building Envelope Thermal Anomalies (BETAs). Over 400 literature citations were examined, and 150 industrial interviews conducted. A summary of these surveys is reported verbally; the nature of the project does not yield quantitative results. Volume I contains a categorical outline and description of various kinds of BETAs. This outline is an attempt at logical classification which may serve as the framework upon which to build more comprehensive studies. Principal conclusions are: (1) BETAs are common in all types of construction. Many could be eliminated by more careful building practices. (2) More research is needed in the assessment of the practical significance of BETAs. (3) Moisture effects resulting from BETAs may be more serious than thermal losses. (4) Some elementary thermal break techniques have been developed in the metal building and refrigerated vehicle industries. (5) Materials have been developed that have sufficient strength and reduced thermal conductivity to form effective thermal breaks, but high first cost may prevent their use. (6) First cost may dominate decisions on changes in construction materials and techniques to eliminate BETAs, even though such changes could be justified on a life-cycle cost basis.

**46674 (ORNL/TM—9630) Strategy for accelerating the use of energy conserving building technologies.** Brown, M.A.; Soderstrom, E.J.; Copenhaver, E.D.; Sorensen, J.H. (Oak Ridge National Lab., TN (USA)). Jul 1985. Contract AC05-84OR21400. 32p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85018171.

To accelerate the use of energy-conserving building technologies in the far-flung, decentralized buildings industry, a strategy for more directed transfer of government research to public- and private-sector users has been implemented. The strategy involves a cycle of four sets of activities: (1) needs assessment; (2) development of transferable information; (3) outreach activities; and (4) feedback and evaluation. By employing this iterative technology transfer cycle and emphasizing trade and professional organizations as communication channels to and from users, it is hoped that research sponsored by the US Department of Energy's Building Systems Division will be responsive to industry needs and accessible to the diverse participants in the buildings industry. 34 refs.

**46675 (PNL-SA—12823) End-use loads and conservation assessment program ancillary database planning and specification.** King, M.J. (Pacific Northwest Labs., Richland, WA (USA)). Dec 1984. Contract AC06-76RL01830. 28p. NTIS.

The End-Use Loads and Conservation Assessment Program (ELCAP) is a large, end-use, hourly metering experiment composed of a number of individual metering projects. On the residential side, two projects are underway. The first is a sample of 500 residential units (attached and detached) drawn from a stratified sample from the 1983 Pacific Northwest Residential Energy Consumption Survey, or PNRES. An additional 200 residential dwellings will be metered in a controlled experiment to determine the effects of the Northwest Power Planning Council's model energy conservation standards. The commercial work consists of three studies. In the first, 200 commercial buildings in the Seattle City Light service area are being metered. Thirty of the instrumented buildings will have been constructed according to the Seattle Energy Code (adopted in 1981), while the remaining 170 buildings will be randomly selected to represent pre-code construction. In the second study, in support of the Commercial Audit Program, approximately 40 commercial buildings are to be given energy audits and metered to determine the appropriateness of the audit recommendations and the accuracy of the estimated energy savings from retrofit. An additional 27 buildings will be metered to document the energy savings of the Purchase of Energy Savings Program, a pilot project to procure energy conservation through third party shared savings contracts. The results of the studies are presented.

**46676 (SBI-MEDD—48) Energy control in greenhouse gardening. Gardening-technological seminar at Tune Agricultural School 1983.** Stroem, J.S. (ed.). (Statens Byggeforskningsinstitut, Hoersholm (Denmark)). 1984. 151p. (In Danish). (CONF-8303204—). NTIS (US Sales Only), PC A08/MF A01. File Number DE85752645.

From Energy control in greenhouse gardening; Tune, Denmark (1 Mar 1983).

Energy management is the basis for systematic and optimal energy utilization. It is discussed how the energy management method may be applied in greenhouse gardening. The emphasis is put on oil-fueled heating systems, on methods of energy measurements, and on methods to analyse the collected energy data.

**46677** (SBI-MEDD—48, pp 8-18) **Energy management in general.** Rasmussen, H.Chr. (Laboratoriet for Energiforskning, Odense, Denmark). 1984. (In Danish). NTIS (US Sales Only), PC A08/MF A01. File Number DE85752645. (CONF-8303204—).

From Energy control in greenhouse gardening; Tune, Denmark (1 Mar 1983).

EFP-81, EFP-82, EFP-83.

The concept energy management covers a method for systematically securing an optimum utilization of purchased energy. The establishment of energy management in an industry consists of the following steps: a) determination of energy key figures, b) providing data on energy consumption, c) preparation of an energy budget, d) energy measurements, e) comparison of measurement results and budget, f) planning and implementation of operational improvements and g) preparation of a revised energy budget. After these steps the energy management is established, step d to g being a standing routine. In a commissioning period the aim is primarily a better energy economy by identifying and reducing waste of energy. Later the basic aim will be to give a high priority to energy conservation measures as a basis of systematic improvements.

**46678** (SBI-MEDD—48, pp 19-38) **Proposal of energy management in greenhouse gardening.** Skov, O. (Statens Byggeforskningsinstitut, Hoersholm, Denmark). 1984. (In Danish). NTIS (US Sales Only), PC A08/MF A01. File Number DE85752645. (CONF-8303204—).

From Energy control in greenhouse gardening; Tune, Denmark (1 Mar 1983).

EFP-81, EFP-82, EFP-83.

Energy management is a method to secure energy-economic operation of a greenhouse gardening by using registration forms, check lists, calculation forms etc., which by correct use is able to secure that the energy consumption and temperatures always are controlled, and that errors or deviations that increase the energy consumption will be found quickly. The energy management method includes the following elements: a) The present state, which is a description of gardening's actual technical and energy standard; b) The activity part, which, based on data and informations of the present state, indicates the activities that must be carried out in order to control the energy consumption. Energy management can be used for every energy consuming process, no matter which energy source is used. Energy management can be used for the whole greenhouse gardening and/or for the single greenhouse. The time periode of control can be one week, fourteen days, or one month.

**46679** (SBI-MEDD—48, pp 66-76) **Dimensioning of heating systems.** Nielsen, V. (Kongelige Veterinaer- og Landbohoejskole, Copenhagen, Denmark). 1984. (In Danish). NTIS (US Sales Only), PC A08/MF A01. File Number DE85752645. (CONF-8303204—).

From Energy control in greenhouse gardening; Tune, Denmark (1 Mar 1983).

EFP-81, EFP-82, EFP-83.

Dimensioning of a greenhouse heating system includes: calculation of the effect demand (transmission loss), dimensioning of

heating surfaces, and dimensioning of the main pipes and circulation pumps.

46680 (SBI-MEDD—48, pp 77-85) **Heating systems easy to meter.** Nielsen, J.S.R. (Birch og Krogboe, Raadgivende Ingenioerer K/S). 1984. (In Danish). NTIS (US Sales Only), PC A08/MF A01. File Number DE85752645. (CONF-8303204—).

From Energy control in greenhouse gardening; Tune, Denmark (1 Mar 1983).

EFP-81, EFP-82, EFP-83.

The basis for a well working heating system is that it is planned in such a way that the measuring equipment may be placed correctly. A heating system that is easy to measure and control must satisfy several requirements: 1) All temperature censors must be placed in pipes in which there always is sufficient circulation for a correct heat transfer from fluid to sensor. 2) All mixing arrangements must be made in such a way that unintentional circulation is avoided. 3) The different terminal parts of the heating systems must be planned so that they do not effect each others energy supply. 4) All meters that are connected to a certain consumption part must be placed so that the metering correctly will show the consumption and not be affected by other consumers. 5) The heating system must be dimensioned correctly concerning the regulators. 6) All the measuring equipment must be specified in detail.

46681 (SBI-MEDD—48, pp 86-97) **Control of heating systems.** Christiansen, J. (Statens Byggeforskningsinstitut, Hoersholm, Denmark). 1984. (In Danish). NTIS (US Sales Only), PC A08/MF A01. File Number DE85752645. (CONF-8303204—).

From Energy control in greenhouse gardening; Tune, Denmark (1 Mar 1983).

EFP-81, EFP-82, EFP-83.

Control of heating systems is a systematic calculation and adjustment of water flows in the different cycles so that the riglet water flows will run in all the 'short circuits'. The pump adjustment will secure the correct water flows. The control system is based on different valves in the heat distribution pipes.

46682 (SBI-MEDD—48, pp 117-126) **Heat metering in greenhouse gardenings.** Traberg-Borup, S. (Statens Byggeforskningsinstitut, Hoersholm, Denmark). 1984. (In Danish). NTIS (US Sales Only), PC A08/MF A01. File Number DE85752645. (CONF-8303204—).

From Energy control in greenhouse gardening; Tune, Denmark (1 Mar 1983).

EFP-81, EFP-82, EFP-83.

A presentation is given of the definition of the relative inaccuracy of the result of an energy measurement in the hot water cycle in a greenhouse gardening. The measuring equipment used in the calculations are two temperature transducers and one flow sensor. The relative inaccuracy of the energy measurement depends on the cooling of the heating water in the measured cycle. Heating systems in greenhouses are always dimensioned to work optimumly at a specific cooling of the heating water (e.g. 20sup(o)C). The calculations show that cooling of the heating water of 90-70 = 20sup(o)C will cause an inaccuracy of 3.8% of the energy measurement, while a cooling of only 2sup(o)C will result in a relative inaccuracy of 22%.

46683 (SBI-MEDD—48, pp 127-137) **Measurement of oil consumption for fueling.** Lassen Landorph, D. 1984. (In Danish). NTIS (US Sales Only), PC A08/MF A01. File Number DE85752645. (CONF-8303204—).

From Energy control in greenhouse gardening; Tune, Denmark (1 Mar 1983).

EFP-81, EFP-82, EFP-83.

The principles of measuring the quantity of oil for fueling are discussed. Specially the principles for the measuring equipment at the control boiler at Havebrugscentret, Aarslev, Denmark, are described. The measuring instruments are pressure transmitters and piezo-resistive probes for level measurements in the oil storage tanks, counters for the operation time of the oil burners, and oil flowmeters for each oil furnace. The reasons for choosing the above mentioned instruments for closer analysis are reported. The requirements of the measuring accuracy and the reproducibility of the equipment are specified. At last the experiences obtained till now are summarized.

46684 (SBI-MEDD—48, pp 139-149) **Energy signature for a greenhouse gardening.** Stroem, J.S. (Statens Byggeforskningsinstitut, Hoersholm, Denmark); Kristensen, K. (Dataanalytisk Laboratorium). 1984. (In Danish). NTIS (US Sales Only), PC A08/MF A01. File Number DE85752645. (CONF-8303204—).

From Energy control in greenhouse gardening; Tune, Denmark (1 Mar 1983).

EFP-81, EFP-82, EFP-83.

Different forms of specific energy signatures for gardening are analysed based on easily accessible data including the outdoor temperature as the most important weather parameter. Easily accessible data are: energy consumption, production area, thermostat setting, and weather data. Based on data from 1982 for one pot plant gardening it is discussed how good the energy signatures are, and what improvements there may be obtained by incorporating other outdoor climate parameters. Weekly mean values are used as energy registrations normally only are made once a week. In addition random variations are equalized by using suitably long periods. The conclusion is that the energy consumption of the analysed gardening can be described with good accuracy by means of outdoor and indoor temperatures. The description can be improved by incorporating wind conditions and insolation, but this improvement is surprisingly small.

46685 (SBI-R—164) **Influence of residential habits on energy consumption in multi-story housing.** Jensen, O. (Statens Byggeforskningsinstitut, Hoersholm (Denmark)). 1984. 67p. (In Danish). NTIS (US Sales Only), PC A04/MF A01. File Number DE85752628.

EFP-80.

The report describes the results of an investigation of residential habits and their influence on energy consumption - particularly the cosumption of heating and hot water - in multi-story housing. There seems to be a considerable need for an information effort in this field, but not even very precise information for practical use is enough to make the residents change their consumption habits to any substantial extent. This can only be achieved through activating a conscious attitude among the residents. In reaching these aims, the housing estate, its administration and residents should play a large and active role. This is partly due to the fact that the preparation and settling of accounts are carried out with the participation of the residents themselves. Furthermore, the local estate is a natural frame for the residents daily life and social situation, as compared to national campaigns for energy-saving. Therefore, within the housing estate there are better possibilities - through discussions among the residents and through social interaction - of increasing the motivation of the individual resident for saving energy.

46686 (STU—80-3085) **Flow of energy and exergy in industrial processes.** Wall, G. (SEE CODE- 9860198 Styrelsen foer Teknisk Utveckling, Stockholm (Sweden)). Nov 1983. 73p. (In Swedish). (SIKOB—1828). NTIS (US Sales Only), PC A04/MF A01. File Number DE85752515.

The concepts needed in exergy studies are defined. The importance of scientifically based definitions, independent of existing technology is stressed. Very often the description of a problem will become an obstacle for important technological progress. The energy and exergy flows of pulp and paper industry and steel industry are exemplified in detail. The energy losses are discussed. The heating systems of buildings are described as the largest single exergy saving potential. Some of the most frequently used energy forms are calculated in relation to their energy and exergy value, long term planning of research is recommended.

46687 (TVA/OP/ECR—82/42-Vol.1) **Energy design guidelines for schools. Volume 1.** Floyd, S. (Tennessee Valley Authority, Chattanooga (USA). Div. of Conservation and Energy Management). Mar 1985. 154p. NTIS, PC A08/MF A01. File Number DE85901744.

Written primarily for architects, this manual also contains information useful for engineers, educational facilities planners and others who shape schools through their policies and directions. The

publication of Energy Design Guidelines to inform these decision-makers in the building industry represents an approach different from the energy standards and budgets used by some governmental organizations. The emphasis here is based on the assumption that given the opportunity, a design professional or decisionmaker will do the best job possible within the many constraints that normally act on a building project. An effort has been made in this publication to point out the opportunities to make the most of the budget, the site, and building opportunities to solve the needs of the eventual building users.

**46688 (VTT-TUTK—335) Exhaust air heat pumps in blocks of flat.** Wiksten, R. (Valtion Teknillinen Tutkimuskeskus, Espoo (Finland)). Jan 1985. 89p. (In Finnish). NTIS (US Sales Only), PC A05/MF A01. File Number DE85752573.

In the report the various possibilities of connecting an exhaust air heat pump to the heating and ventilating system of a building are presented. The possibilities of installing an exhaust air heat pump in various buildings are also examined. The exhaust air heat pump is best suited for a multi-family house with ventilation by an exhaust air fan. The portion of an exhaust air heat pump in heating the building and domestic hot water is calculated. According to the calculations the exhaust air heat pump can cover 15-80% of the energy demand of the building, depending on the construction of the heat pump and the magnitude of ventilation. The designing criteria for the water tank for the domestic hot water are presented. In an extreme case, the water tank is not needed at all. The influence of an exhaust air heat pump on the other heating system of the building (oil or district heating) is calculated. An analysis of the profitability of an exhaust air heat pump is made for a few typical cases.

**46689 Impact of daylighting on peak electric demand.** Choi, U.S.; Johnson, R.; Selkowitz, S. (Lawrence Berkeley Lab., CA). *Energy and Buildings;* 6: 387-399(1984). Contract AC03-76SF00098.

A complete analysis of the cost-effectiveness of daylighting strategies should include the impact of daylighting on peak electrical demand as well as on energy consumption. An hour-by-hour building energy analysis program was used to study the thermal and daylighting impacts of fenestration on peak demand. Fenestration properties and lighting system characteristics were varied parametrically for office buildings in Madison, WI and Lake Charles, LA. Peak electrical demand was disaggregated by component and by zone, monthly patterns of peak demand were examined, and impacts of fenestration performance on chiller size were studied. The results suggest that for daylighted office buildings, the peak electrical demand results from a complex trade-off between cooling load due to fenestration parameters, lighting load reductions due to glazing and lighting system characteristics. Lowest peak demands generally occur with small to moderate size apertures. With daylighting, peak electrical demand is reduced by 10 to 20% for the building configuration studied (37% perimeter zone, 63% core zone). This work indicates that solar gain through fenestration must be effectively controlled in order to realize the potential of daylighting to significantly reduce peak electrical demand.

**46690 Development of Cherepnov lifter for water supply and small hydroelectric power generation.** Liu, H.; Fessehaye, M.; Geekie, R.; Wessel, M.S. (Department of Civil Engineering University of Missouri-Columbia, Columbia, Missouri). pp 159-162 of Advances in energy technology. Proceedings eighth annual UMR-DNR Conf. on energy, November 4-7, 1981, Rolla, MO. Sauer, H.J.; Hegler, B.E. Rolla, MO; Univ of Missouri-Rolla (1981). (CONF-811137—).

From University of Missouri Department of Natural Resources conference on energy; Rolla, MO, USA (6 Nov 1981).

Under contract by the U.S. Department of Energy, the University of Missouri-Columbia is investigating and developing a special water lifter--the Cherepnov lifter -- for head augmentation in low-head hydroelectric power generation. The same lifter developed for hydropower can also be used for water supply to farms, homes, industries and communities when a suitable water source is available. The paper reports the current status of the development work and anticipated results.

## 3203 Industry And Agriculture

*REFER ALSO TO CITATION(S) 46020, 46064, 46065, 46334, 46337, 46686, 46688*

**46691 (BLG—561) Evaluation of the Energy Bus System in Belgium.** Geypen, L.; Schietecatte, W.; Wouters, G. (Centre d'Etude de l'Energie Nucleaire, Brussels (Belgium)). Feb 1984. 46p. (In Dutch). NTIS, PC A03/MF A01. File Number DE85901916.

This report gives the results of an inquiry carried out at seventy companies on the follow-up of energy saving advices given during the energy bus visits. The inquiry has been made by means of a questionnaire filled-up by the first seventy companies which had been visited by the S.C.K./C.E.N. energy bus. The energy audits are carried out in the scope of the Belgian energy bus project, an energy auditing system sponsored by the government in view of promoting energy conservation in small and medium sized companies. In the first part of the report the energy bus system is presented and the follow-up inquiry is situated in the project scheme. The second part deals successively with the activities of the companies, the data collection methodology and the results of the inquiry. In the questionnaire the companies have been asked respectively about the actual energy management situation in the company, about the execution of the suggested energy saving possibilities and about their general opinion on the energy bus system. Special attention has been paid to the follow-up of the energy saving advices. For executed measures achieved energy savings and investment costs have been collected, while for not executed measures the reasons of non execution have been asked for. The collected data are presented and evaluated and some preliminary conclusions are given with respect to the energy bus system. The questionnaire and the statistically treated data of the inquiry are given in appendix.

**46692 (CONF-8210340—1) Thermophysical properties of industrial insulators.** McElroy, D.L.; Neuer, G.; Tye, R.P. (Oak Ridge National Lab., TN (USA); Stuttgart Univ. (Germany, F.R.). Inst. fuer Kernenergetik und Energiesysteme; Energy Materials Testing Lab., Biddeford, ME (USA)). 1982. Contract AC05-84OR21400. 6p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016152.

From 8. European thermal physical properties; Baden, F.R. Germany (2 Oct 1982).

Since 1976, a group of concerned workers representing all sectors, including government, manufacturers, users and general interest parties, working within ISO TC163 Thermal Insulation Committee, have attempted to draw attention to the subject of industrial insulation. The present Workshop or forum is an attempt to reach a broader audience and to try to obtain some consensus on the definition and resolution of major problem areas, many of which relate directly to thermal properties and performance. The results and conclusions of the assessment centered upon four major areas: (1) the economic impact of energy conservation in the industrial insulation field, and the possible needs for government action; (2) technical problems associated with the existing materials; (3) technical problems related to the evaluation of the thermal and other properties of materials under conditions of actual use; and (4) the need for education, particularly of the designer and the installer.

**46693 (DTH-LV-R—85-6) Testing of a chemical heat pump-storage with salt solution as sorbent.** Dyrnum, O. (Danmarks Tekniske Hoejskole, Lyngby. Lab. for Varmeisolering). Mar 1985. 64p. (In Danish). NTIS (US Sales Only), PC A04/MF A01. File Number DE85752657.

EFP-84.

A chemical heat pump has been designed and built. The heat pump is utilizing an aqueous solution of sodium hydroxide as absorbent for low pressure steam. Two series of experiments have been carried out. In the first series both sides in the heat pump contained pure water. The aim of these experiments was to establish the mode of operation and the characteristics of the heat pump. In the second series one side in the heat pump contained pure water and the other contained 50% aqueous sodium hydroxide. The aim of these experiments was to verify the heat pump's capability of

storing and recovering heat energy from a chemical heat store. In connection with a heat reservoir at 20 degC it has been possible for the heat pump to charge the heat store by induction of thermal energy at 70degC. By exploiting the stored energy, thermal energy at a temperature of 57degC was supplied by the heat pump. Powers of 50-60 W have been measured being in good agreement with the theoretical calculations. An upscaling of the effect is a simple question of dimensioning.

46694 **(EUR—8860) Industrial applications of high temperature gas engine driven heat pumps.** Eustace, V.A.; Smith, S.J. (Commission of the European Communities, Luxembourg). 1984. 41p. Commission of the European Communities, Luxembourg.

This work was undertaken during Phase III of the high temperature heat pump project covering industrial applications of the unit. Four potential applications of the heat pumps that have been identified are: in the chemical industry, a distillery, a maize cooking process and in a dye-house, and these are examined in some detail. An experimental programme has been carried out using the IRD heat pump to obtain data on the off-design and part load running conditions. The range of permissible off-design running conditions (limited mainly by the refrigerant compressor) was with suction temperature in the range 40°C to 60°C and a condensing temperature of 120°C. The heat pump was also run at loads from 50% to 120% of the design output. Operation and performance of the system proved satisfactory throughout the test programme. No decomposition of the compressor oil or refrigerant had been observed during the test period.

46695 **(EUR—9169-EN) Energy saving in edible oil processing plants by application of a total-energy (TE) system.** Ong, T.L. (Commission of the European Communities, Luxembourg. Directorate-General for Information, Market and Innovation). 1984. 20p. Commission of the European Communities, Luxembourg. Office of Official Publications of the European Communities.

An investigation has been made into the feasibility to save primary energy carriers by application of a Total-Energy system, in the following types of edible oil processing plants: a. soybean extraction; b. soybean oil refinery; c. margarine manufacture.

46696 **(KVL-JI-MEDD—47) Use of gas scrubbers for heat extraction from straw furnaces.** Kofoed Nielsen, H. (Kongelige Veterinaer- og Landbohoejskole, Tastrup (Denmark). Jordbrugsteknisk Inst.). Mar 1984. 55p. NTIS (US Sales Only), PC A04/MF A01. File Number DE85752665.

The purpose of the project has been to improve the efficiency of straw furnaces by cooling down the flue gas below dew point and thus make the upper calorific value of straw a realistic target for energy utilization. The heat exchanger to be used is a gas scrubber. The course of the project has been: a) Basic experiments with gas scrubbers as heat exchangers for very hot air. b) Design, construction and test of a prototype flue gas scrubber for a commercial straw furnace. The scrubber improved the efficiency from 70% to 90% of the lower calorific value of the straw supplied. No major problems were found. c) Design, construction and test of a special straw combustor i.e. a cyclone furnace with the flue gas scrubber as sole heat exchanger. This system is cheap and has, compared to other furnaces a high efficiency (approximately 79%). Apart from being an efficient heat exchanger the scrubber reduces the particle emission by 80-90%.

46697 **(NP—5752636) Organic wastes from fishing industry for energy purposes. Phase 1. Energy potential.** (Vandkvalitetsinstituttet, Hoersholm (Denmark)). [1985]. 81p. (In Danish). NTIS (US Sales Only), PC A05/MF A01. File Number DE85752636.

Energy resources in the Danish fish processing industry have been evaluated to be 10-25 mln Dkr. distributed over few enterprises. Any specific economic calculations have to be based on pilot projects concerning anaerobic digestion of fish industry wastes. Three processing types were investigated: herring and mackerel, mussles and fish meat industry. Biogas yield was evaluated for a continuous digestion in bioreactors with permanent biofilms in an industrial-scale plant. Energy conservation is achieved as well in the respective water treatment plants as waste water passing through the digestion bioreactors is much less polluted.

46698 **(NP—5752639) Fly ash as load-bearing filling material on a water covered surface.** Foged, N.; Larsen, P.; Lorin Rasmussen, J.; Soerensen, J.L. (Geoteknisk Inst., Lyngby (Denmark)). Feb 1985. vp. (In Danish). Geoteknisk Inst., Lyngby (Denmark).

EFP-83.

The present test project studies the possibilites of: carrying out accelerated tests in the laboratory in order to determine the development of strength and its final value, by storing at increased temperatures as it is done routinely in the concrete technology - using a well-known accelerator in concrete technology, $CaCl_2$, to improve the hardening of wetted fly ash. The development and strength in samples built of fly ash from the Stigsnaes Power Station has been examined. The strength at failure, $\sigma_{sub(c)}$, and the modulus of elasticity, E, as well as the classification properties and the content of free lime, CaO, have been determined for 124 samples. The investigations have shown that it is possible to accelerate the laboratory tests with a factor of about 3 by changing the storage temperature from 20sup(o)C to 40sup(o)C. During the period of the investigation the DGI has, together with the Foundations Laboratory of the Danish Techncial University, directed various examination projects and Master's thesis concerned with fly ash. The main results of these efforts have also been used in the estimation of the hardening and its physical and chemical background.

46699 **(NP—5752644) Energy conservation in heat singeing of swine carcasses - rind processing.** Molander, E.; Wismer-Pedersen, J. (Kongelige Veterinaer- og Landbohoejskole, Copenhagen (Denmark)). Jan 1985. 31p. (In Danish). Kongelige Veterinaer- og Landbohoejskole, Copenhagen (Denmark).

EFP-81.

Singeing of pork carcasses as part of the slaughter operation gives the rind a desirable texture and appearance and sterilizes the surface. The traditional singeing is done in oil burning ovens at temperatures around 900sup(o)C in 16 seconds. In the process the surface layer is charred and the carcasses go consequently through a thorough cleaning procedure. The whole operation is expensive and considerable interest has been given over the years to develop alternative methods. Research in this department on the traditional singeing process has shown that the heat treatment induces shrinkage of the collagen fibers of the rind. The desirable texture of the rind is thereby achieved. Histological examinations of rind structure have identified the effects on the various layers. From these observations it became clear that the chemical processes induced by the singeing were extensions of the effects of the scalding operation to which the carcasses are subjected prior to the singeing. Work with dipping pork carcasses in hot water at 90-95sup(o)C for 30-60 seconds were found to completely reproduce the effect of singeing without resulting in the charred layer. When the charred layer on the carcasses is not produced, the extensive cleaning operation can be reduced to a minimum. It has been controlled that the bacteriological quality of the carcasses treated in hot water is sufficient.

46700 **(PB—85-189538/XAB) Large-scale applications of heat pumps.** Taylor, B.J.; Bertinat, M.P.; Heaton, A.V.; Benstead, R.; Hodgett, D.L. (Electricity Council Research Centre, Capenhurst (UK)). 1984. 42p. (CONF-840908—; ECRC/M—1859). NTIS, PC E04/MF E04.

From 2. BHRA international symposium on the large scale applications of heat pumps; York, UK (25 Sep 1984).

Sponsored by British Hydromechanics Research Association, Cranfield (England). Presented at BHRA International Symposium (2nd), York (England). September 25-27, 1984.

Contents include: design and evaluation of a 150C heat pump; steam recompression drying; and assessment of heat-pump-assisted distillation using thermodynamic criteria.

46701 **(PB—85-193811/XAB) Estimation of energy and cost savings arising from rationalisation of milk-assembly operations. Final report.** Herlihy, P.; Butler, M.; Pitts, E. (Commission of the European Communities, Luxembourg). 1984. 136p. (EUR—9272-EN). NTIS, PC E07/MF E07.

A mathematical model of the transport component of the milk assembly operation is developed which relates the cost and energy requirements of milk assembly to the parameters of a given assembly operation, in particular the average size of supplier and the density of suppliers. A major feature of this model is that it allows an optimal truck size to be calculated and this allows the effects of changes in truck size to be incorporated in subsequent analyses. This model is used to estimate the likely fuel and cost savings in the transport operation from the rationalization of catchment areas between collection agencies. It is also used to estimate the savings in fuel and cost in the transport operation due to less-frequent collection of milk. These savings are compared to the increased fuel use and costs on farms due to less-frequent collection. The application of computer routing techniques to the milk-assembly operation is also considered. Four commercial routing packages were selected and tested on two problems, one theoretical and one practical. Some of the special features of the use of computer packages in the milk-assembly area were considered.

46702 **(SLU-LBT—42) Waste heat for growing horticultural crops.** Haakansson, B.; Boerjesson, L.; Sakshaug, K.; Magnusson, G. (Swedish Univ. of Agricultural Sciences, Lund. Dept. of Farm Buildings). 1984. 128p. (In Swedish). NTIS (US Sales Only), PC A07/MF A01. File Number DE85752546.

An experimental area for heating soil was built at Alnarp in the autumn of 1979. Plastic pipes were placed in the soil in three different combinations of depths and pipe spacings: depth 30 cm - spacing 30 cm, depth 60 cm - spacing 30 cm and depth 60 cm - spacing 70 cm. Waste heat was simulated by heating water to 20 degreeC and 30 degreeC and pumping it through the pipes. Consequently, the soil was heated in six different ways: three different combinations of pipes and two different levels of water temperature. Two different unheated control areas were also included in the experimental field. The heating of the soil caused an increase in temperature at a depth of 15 cm during spring. The increase was 3-8 degreeC in experimental areas not covered with plastic foil. In experimental areas with plastic cover the soil temperature was 4-9 degreeC more than that in the control areas. Under the plastic tunnels and under small plastic greenhouses the temperature increase was 5-10 degreeC. The biological experiments began in the spring of 1980 and were carried out during three growing seasons. Different crops were grown both without covering and with different types of plastic cover. The main vegetable crops were lettuce, early potatoes, radish, parsley and leek.

46703 **(VTT-TUTK—318) Energy economics in food industry.** Taimisto, O.; Kaijaluoto, S.; Mokkila, M.; Paloheimo, M. (Valtion Teknillinen Tutkimuskeskus, Espoo (Finland)). Oct 1984. 130p. (In Finnish). NTIS (US Sales Only), PC A07/MF A01. File Number DE85752572.

The percentage of energy costs in the reviewed industry sectors. bakeries and dairies not included, is 2.5% of the turnover. In the sugar industry it is as high as 6%. The percentage of energy costs is 7% of that of raw materials and 25% of that of the salaries. The energy is mainly consumed in the form of steam or electricity. The proportion of electricity of the consumed primary energy averaged 24%. A case study of energy consumption and conservation is made in five different processing plants: a sausage factory, a slaughter-house, a margarine factory, an oil refinery and an animal feedstuff factory. The most important targets of energy recovery were hot primary condensates, heat of condensation from the refrigeration systems and the heat carried out in the exhaust air. In some cases the condensate could have been used as such instead of draining. A survey of the consumption of energy in different unit processes was done and in some cases large variations, partly due to unproper maintenance, were detected. The economy of some processes could be improved with a few simple technical improvements and adjustments. The measures that can be taken for energy recovery vary between the different industry sectors but within the separate sectors they are more uniform. An energy balance introduced in form of a Sankey diagram provides an excellent tool for feasibility studies of different recovery systems.

## 3206 Municipalities And Community Systems

*REFER ALSO TO CITATION(S) 45992, 46987*

46704 **(BMFT-FB-T—85-062) Operating analysis of the sewage sludge drying plant at Alfeld.** Bahrs, D.; Albers, H. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Jul 1985. 124p. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE85752704.

In 1979 a new sludge drying plant was put into operation at the Alfeld sewage treatment works. This plant uses digester gas as source of heat energy for drying the mechanically drained digested sludge. An extensive recovery of this energy for heating the digester is the particular characteristic of this system, so that a self-supporting thermal operation can be made possible. The aim of this research was to give a comprehensive description of this drying technique. Investigations about the efficiency of this system, about need for energy and maintenance and about costs were made. The specific conditions like utilization of the plant and characteristics of the sludge were determined. This system of sludge drying has fulfilled the main expectations. Although present conditions are worse than assumed at projecting self-supporting thermal operation is achieved all over the year. All the dried sludge can be sold. But the costs are very high because of the low degree of utilization.

46705 (DOE/METC—84-34, pp 199-208) **Radiation degradation and biodegradation in laundry wastes by $\gamma$ irradiation.** Kuo, P.C.; Chou, T.S. (Atomic Energy Council, China). Sep 1984. NTIS, PC A22/MF A01. File Number DE85001957. (CONF-831244—).

From 2. conference on management of municipal, hazardous, and coal wastes; Miami Beach, FL, USA (5 Dec 1983).

The interaction of water and organic compounds by $\gamma$ radiation leads to radiolysis effect. Three main results are obtained from the nonbiodegradable alkyl benzene sulfonate (ABS) irradiated with $\gamma$ ray. Firstly, about 27.6% of ABS is destroyed at dosage of $1.9 \times 10^4$ rad and ABS is almost completely destroyed at $1.2 \times 10^6$ rad. Maximum decomposition of ABS occurs at pH = 6. Secondly, some low molecular weight compounds formed in ABS by radiation are volatilized and high molecular weight compounds formed in ABS are gels. At a dosage of $10^4$ rad the weight percentage reduction of carbon, hydrogen, and sulfur in ABS reads 2.68, 1.15, and 3.15 respectively, while at $10^8$ rad the same reduction reads 20.6, 18.5, and 22.0. Reduction of BOD in the waste water occurs at high dose. Thirdly, in biodegradation it is found that the bacteria propagation depends on the total radiation dose; the excess radiation dose produces macropolymers which may be more resistant to biodegradation than the parent. 8 references, 20 figures, 4 tables.

46706 **(NP—5752654) City of Columbus, Ohio, district heating project. A conceptual study by HML. Background for the study.** (Harry og Mogens Larsen A/S, Odense (Denmark)). Apr 1984. 196p. Harry og Mogens Larsen A/S, Odense (Denmark).

This report summarizes the background for the Study, the development of its concept, the process of selection of Columbus as the Subject City, and the basis for this undertaking. Briefly, the purpose of the project is to demonstrate effectively the energy cost saving benefits and potential of district heating, its relevance to USA, and the advantages emerging from an adaption and US application of cencepts and technology used in developing Danish district heating systems. From the Danish point of view, the incentives for financing and undertaking such a Project Study are the reawakened interest in district heating in the United States and the possibilities of assessing and participating in a large DH market. This report summarizes as stated the background for the Study, that is to say, the events leading up to the start of the initial engineering work on the Subject City, Columbus, As far as possible these events and their outcomes are presented and described in chronological order and, where necessary, are supplemented by additional information in the form of Appendices at the back of the reports, or as supportive material in the relevant section of the report.

46707 **(NP—5752655) City of Columbus, Ohio, district heating project. A conceptual study by HML. Feasibility study.** (Harry og Mogens Larsen A/S, Odense (Denmark)). Aug 1984. 439p. Harry og Mogens Larsen A/S, Odense (Denmark).

In the process of building up a picture of Columbus, from which areas of possible DH potential are to be identified and selected, HML have 'leaned' heavily upon the property data provided by Applied Analytics Inc., of Long Island, New York as described in the preceding report, 'Framework for District Heating'. This data has been supplemented calculations made by HML and cross-referenced for categories of building system, fuel and property type found and have been analyzed by HML for implications, demand and supply conditions, and property mix. The relevance and effect of estimating and applying a simultaneous demand factor for load, sizing and costing purposes has been specially emphasized. Special attention is given to pointing out, and commenting upon the different types of mains available for use and application. HML have selected a piping system type appropriate to the DH projects. The system type selected is a prefabricated and pre-insulated coaxial type of system using a carbon steel bearer or inner service pipe, on foamed polyurethane insulating annulus and a high density polyethylene tubing a as its casing. Some of the heat source potential in Columbus is identified and described. Primary 'targets' were the municipally owned Trash Burning Power Plant (TBPP) in Project Area South and the Annheuser-Busch Brewery (ABB) on the northern outskirts of the City in project Area North. The heat source pointed out as the most likely potential for a DH system is also the municipally owned Dublin Avenue Power Station. Eventually it may prove feasible to expand district heating beyond the selected Project Areas in the form of 'link-up' projects to the North and South of Downtown Columbus, whereby the opportunity to fully exploit the waste and surplus heat potential in Columbus, and to optimize system operations throughout the year, is presented.

46708 **(NP—5752656) City of Columbus, Ohio, district heating project. A conceptual study by HML. Framework for district heating.** (Harry og Mogens Larsen A/S, Odense (Denmark)). May 1984. 306p. Harry og Mogens Larsen A/S, Odense (Denmark).

This report is the second in a series of three which collectively cover the work and findings of HML in respect of an investigative study into the potential for establishing district heating in the city of Columbus, Ohio, on a feasible basis. It contains some of the more cost relevant and influential data and sources of reference. Although 'residential district heating' has been very succesful in Denmark, United Kingdom and elsewhere in Europe, HML are well aware that different market conditions in USA could prohibit any automatic repetition of this level of success, for example, in Columbus. In the process of building up a picture of Colubmus as an energy consumer and potential user of district heating, HML acquired the services of American experts. The work of two of these is summarized in two reports reproduced here in their entirety. Applied Analytics of Long Island, New York, was commissioned to determine by computer the energy demands of the residential, Institutional and commercial sector consumers of most of Franklin County, Ohio, encompassing the City of Columbus and a number of strategically located communities not under the City's jurisdiction, and to map by census tract the space heating and hot water service demands (the enclosed report 'Columbus, Ohio - Estimation of Residential and Commercial Energy Demand'). Generally, therefore, this report can be regarded as summarizing the preliminary stage of work, the data collection stage, during which the basic information and data required for the subsequent study calculations, design, sizing, etc., has been collected. The true 'typicality' value of the Columbus Study data will emerge only from future comparisons with other study projects where similar data is derived.

46709 **(NP—5770359) Genesis, dynamics and ecology of soils near a sanitary landfill.** Mouimou Djekore. (Technische Univ. Berlin (Germany, F.R.). Fachbereich Landschaftsentwicklung). 2 Feb 1984. 123p. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE85770359.

A sanitary landfill which is in the forest of Dueppel (Berlin-Wannsee) and its environment were investigated with the aim to clarify soil development as well as their ecological properties. Main characteristics of the soils of sanitary landfills are the production of gas (particularly methane) which influence together with the parent material the formation of horizons and the development of soils. On the uncovered part of the sanitary landfill calcaric Regosols and eutric Regosols with high contents of methane are developed. On the covered part eutric Regosols with different contents of methane in the subsoil mainly could be found. The contents of oxygen in the soils on the sanitary landfill were degraded by rising gases. The deficiency of oxygen around the roots caused the death of many plants on the sanitary landfill and its environment. The habitat with a thick loamy cover showed still the best proportion of oxygen. Relatively high soil temperatures were measured, due to microbiodecomposition processes of the wastes. Available nitrogen was found in form of ammonium mostly. Relatively high concentrations of nitrite were also recorded during springtime. Some practical advice derived from the results could be helpful in recycling and avoiding negative effects of emissions from sanitary landfill of ecosystems around it.

### 3209 Education And Public Relations

*REFER ALSO TO CITATION(S) 46607*

## 33 ADVANCED AUTOMOTIVE PROPULSION SYSTEMS

### 3301 Internal Combustion Engines

46710 **(ORNL-tr—5224) Evaluation of the strength of ceramic radial turbine rotors.** Sasaki, Masanori; Izumi, Takao; Ajiwa, Seiji; Ito, Takane. (Oak Ridge National Lab., TN (USA); Nissan Motor Co. Ltd., Tokyo (Japan). Central Labs.). 1985. Contract AC05-84OR21400. Translated from Proceedings of the thirteenth regular gas turbine conference, June 1985, pp 65-70. 13p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85017022.

The development of turbine rotors that are subjected to high temperature and centrifugal force is one of the most difficult development problems for ceramic parts used for ceramic gas turbines in passenger cars. One of the authors has attempted to evaluate the strength of a small silicon nitride turbine rotor on the basis of 3-point bar breaking strength using the Weakest Link Theory. In this report, a bar breaking test was conducted on a test piece cut out of the actual rotor. A spin strength evaluation was then attempted on the basis of the test results. After continual analysis of causes and improvements in the rotors that fail at a spin speed less than the predicted speed, a few insights have been gained that will contribute to the development of the ceramic radial turbine rotor and are shared in this report.

46711 **(ORNL-tr—5223) Development of ceramic turbine rotors.** Kobayashi, Yoshito; Nakazawa, Norio; Inagaki, Tohji. (Oak Ridge National Lab., TN (USA); Mitsubishi Motors Corp., Tokyo (Japan)). 1985. Contract AC05-84OR21400. Translated from Proceedings of the thirteenth regular gas turbine conference, June 1985, pp 59-64. 11p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85017021.

Mitsubishi Motor Company has been developing gas turbines for use in trucks and is, at the present time, conducting tests using metal turbines. Mitsubishi Motor Company has also performed engine tests at 1120°C turbine inlet temperature (TIT) using a metal air-cooled turbine. On the basis of these tests, the possibility of using gas turbines for high-performance automotive engines has been demonstrated. The only weak point was that fuel consumption was not economical when compared to that of current diesel engines. In order to eliminate this weakness, it is necessary for truck engines to raise the TIT to above 1250°C, and it is therefore essential that ceramics be used. Our company is developing gas turbines with ceramic turbine rotors, which hole the key to realization of high-efficiency gas turbines for use in automobiles and trucks. This paper will discuss and review the hot spin test process for silicon nitride radial-flow turbine rotors.

### 3307 Emission Control

*REFER ALSO TO CITATION(S) 46981*

### 3308 Alternative Fuels

**46712 (STU—82-4477) Turbo - engine for methanol fuel.** Egnell, R. (SEE CODE- 9860198 Styrelsen foer Teknisk Utveckling, Stockholm (Sweden)). Apr 1984. 49p. (In Swedish). NTIS (US Sales Only), PC A03/MF A01. File Number DE85752516.

The test engine is based upon Volkswagen parts and the development was made in three stages. The first engine had an internal volume of 1.1 liter. Its torsional force however was too low at low engine speed. This was improved by increasing the volume to 1.3 liter. The third stage implied the location of the carburettor between the compressor and cylinder top which gave a good acceleration from low revolutions. The original engine of Volkswagen Passat 1982 was used as a reference. The brake power efficiency of the project engine was up to 30% better than the reference. Its energy use under transient conditions was 16% lower than that of the reference. Exhaust of carbon monoxide was lower and the emission of hydrocarbons was higher than for the reference engine. A cold starting system based on propane-gasol was developed and tested in Northern Sweden.

**46713 (STU—83-3173) Investigation of fixed and unfixed pollutants at different combinations of fuel/engine and at various temperatures.** Egebaeck, K.E.; Tejle, G.; Laveskog, A. (SEE CODE- 9860198 Styrelsen foer Teknisk Utveckling, Stockholm (Sweden)). Feb 1984. 142p. (In Swedish). (SNV-PM—1812). NTIS (US Sales Only), PC A07/MF A01. File Number DE85752517.

The exhuast gases of 6 cars have been investigated. The fuels were gasohol, commercial gasoline and gasoline containing 5% ethanol. Emission and consumption of fuel were lower when driving with ethanol mixture than with pure gasoline. Reduction of the emission of CO was significant to 90% if all temperatures were weighted alike.

## 36 MATERIALS

**46714 (IS-M—561) Ultrasonic characterization of porosity using the Kramers-Kronig relations.** Rose, J.H.; Hsu, D.K.; Adler, L. (Ames Lab., IA (USA); Ohio State Univ., Columbus (USA). Dept. of Welding Engineering). 1985. Contract W-7405-ENG-82. 4p. (CONF-8506125—7). NTIS, PC A02/MF A01; GPO Dep. File Number DE85017346.

From Conference on internal friction and ultrasonic attenuation in solids; Urbana, IL, USA (3 Jun 1985).

A new algorithm is proposed to determine the volume fraction of pores in solids using the frequency dependent ultrasonic attenuation. The algorithm was developed by examining the Kramers-Kronig relation between the porosity induced ultrasonic attenuation and the change in sound velocity. The method is tested using data measured for several porous aluminum samples.

**46715 (UCRL—53627) Industrial recovery capability. Final report.** Gregg, D.W. (Lawrence Livermore National Lab., CA (USA)). Dec 1984. Contract W-7405-ENG-48. 30p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85018151.

This report provides an evaluation of the vulnerability - to a nuclear strike, terrorist attack, or natural disaster - of our national capacity to produce chlorine, beryllium, and a particular specialty alumina catalyst required for the production of sulfur. All of these industries are of critical importance to the United States economy. Other industries that were examined and found not to be particularly vulnerable are medicinal drugs and silicon wafers for electronics. Thus, only the three more vulnerable industries are addressed in this report.

**46716 Production of glass or glass-ceramic to metal seals with the application of pressure.** Kelly, M.D.; Kramer, D.P. (to Dept. of Energy). US Patent Application 6-688,671. 4 Jan 1985. 13p. Contract AC04-76DP00053. DE85017746 NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85017746.

In a process for preparing a glass or glass-ceramic to metal seal comprising contacting the glass with the metal and heat-treating the glass and metal under conditions whereby the glass to metal seal is effected and, optionally, the glass is converted to a glass-ceramic, an improvement comprises carrying out the heat-treating step using hot isostatic pressing.

### 3601 Metals And Alloys

*REFER ALSO TO CITATION(S) 45932, 46089, 46090, 46187, 46188, 46188, 46190, 46350, 46402, 46404, 46407, 46411, 46459, 46461, 46461, 46462, 46463, 46574, 46955, 46966, 46968, 46978, 46983, 47512, 47955*

**46717 (BNL—36833) Internal friction due to domain-wall motion in martensitically transformed A15 compounds.** Snead, C.L. Jr.; Welch, D.O. (Brookhaven National Lab., Upton, NY (USA)). 1985. Contract AC02-76CH00016. 12p. (CONF-8506125—8). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85017510.

From Conference on internal friction and ultrasonic attenuation in solids; Urbana, IL, USA (3 Jun 1985).

A lattice instability in A15 materials in some cases leads to a cubic-to-tetragonal martensitic transformation at low temperatures. The transformed material orients in lamellae with c axes alternately aligned along the <100> directions producing domain walls between the lamellae. An internal-friction (δ) feature below T/sub m/ is attributed to stress-induced domain-wall motion. The magnitude of the friction increases as temperature is lowered below T/sub m/ as (1-c/a) increases, and behaves as $(1\text{-}c/a)^2$ from T/sub m/ down to the superconducting critical temperature where the increasing tetragonality is inhibited. The effect of strain in the lattice is to decrease the domain-wall internal friction, but not affect T/sub m/. Neutron-induced disorder and the addition of some third-elements in alloying decrease both δ and T/sub m/, with some elements reducing only the former. Less than 1 at. % H is seen to completely suppress both δ and T/sub m. Martensitically transformed $V_3Zr$ demonstrates low-temperature internal-friction and modulus behavior consists with easy β/m wall motion relative to the easy m/m motion of the A15's. For the $V_3Zr$, a peak in δ is observed, qualitatively in agreement with expected β/m wall motion.

**46718 (CEA-CONF—7433) Defects and microstructures studied by neutron scattering techniques.** Kjems, J.K. (Laboratoire Leon Brillouin, Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). 1984. 16p. (CONF-8409103—5). NTIS (US Sales Only), PC A02/MF A01. File Number DE85752153.

From 5. Riso international symposium on metallurgy and materials science; Roskilde, Denmark (3 Sep 1984).

The application of neutron scattering to study defects and microstructures is discussed with emphasis on the diffuse scattering techniques. Recent results of diffraction studies of texture, residual stresses, and foreign phases are reviewed. An example of Huang scattering due to thermal disorder is mentioned, and the use of this technique is advocated in combination with diffuse and small angle scattering for the study of phase separation and segregation. Finally, the results of extensive studies of the thermally induced disorder in the fluorites using coherent and incoherent quasielastic scattering as well as single-crystal diffraction are summarized.

**46719 (CONF-850211—13) Self-consistent electronic structure of $\alpha$-phase Hume-Rothery electron compound alloys Cu/sub c/Zn/sub 1-c/, Cu/sub c/Ga/sub 1-c/, and Cu/sub c/Ge/sub 1-c/.** Stocks, G.M.; Boring, M.; Nicholson, D.M.; Pinski, F.J.; Johnson, D.D.; Faulkner, J.S.; Gyorffy, B.L. (Oak Ridge National Lab., TN (USA); Los Alamos National Lab., NM (USA); Tennessee Univ., Knoxville (USA); Cincinnati Univ., OH (USA); Bristol Univ. (UK)). 1985. Contract AC05-84OR21400. 22p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85016481.

From 114. AIME annual meeting (includes Society of Mining Engineers); New York, NY, USA (24 Feb 1985).

We have performed charge self-consistent electronic structure calculations for the $\alpha$-phase Hume-Rothery electron compound alloys Cu/sub c/Zn/sub 1-c/, Cu/sub c/Ga/sub 1-c/, and Cu/sub c/Ge/sub 1-c/ having electron to atom ratios 1:1, 1:2, and 1:3 for each alloy series. The calculations are based on the self-consistent-field Korringa-Kohn-Rostoker coherent-potential approximation (KKR-CPA). We show results for the densities of states and Fermi surface of these alloys; the behavior of these quantities is quite different from that predicted on the basis of the rigid band model. We also show results for the ground state properties of the Cu/sub c/Zn/sub 1-c/ alloys that were obtained on the basis of a recent generalization of the density functional theory to random alloys. The theory provides a basis for understanding the concentration variation of the lattice parameter (Vegards' Law) of Cu/sub c/Zn/sub 1-c/ alloys at the microscopic quantum mechanical level.

**46720 (CONF-850670—22) Dynamic analyses of a crack run-arrest experiment in a nonisothermal plate.** Bass, B.R.; Pugh, C.E.; Stamm, H.K. (Oak Ridge National Lab., TN (USA); Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Reaktorbauelemente). Jun 1985. Contract AC05-84OR21400. 11p. NTIS, PC A02/MF A01 - GPO. File Number TI85016420.

From ASME Pressure Vessel and Piping Division conference; New Orleans, LA, USA (24 Jun 1985).

In crack-arrest studies sponsored by the Heavy-Section Steel Technology (HSST) Program, a primary objective has been to produce fracture toughness data for reactor pressure vessel materials at temperatures approaching the Charpy upper-shelf regime. Wide-plate tests being conducted at the National Bureau of Standards for the HSST Program are providing an opportunity to obtain significant numbers of data points at affordable costs. In these tests, a single-edge crack in a wide-plate which is subjected to tensile loading initiates at low temperature and arrests in a region of increased fracture toughness. The gradient in toughness is achieved by applying a linear transverse temperature profile across the plate. The second test in this series for A 533 grade B class 1 steel involves crack initiation in cleavage followed by arrest at a temperature corresponding to Charpy upper-shelf behavior. The plate geometry, the material properties, and the instrumentation are discussed along with conditions and results for this test. Pretest static and elastodynamic analyses are described, and posttest analyses based on actual boundary conditions are shown to compare favorably with the observed run-arrest events.

**46721 (CONF-850777—2) Combined small angle x-ray scattering and transmission electron microscopy studies of Al-Li alloys.** Spooner, S.; Williams, D.B.; Sung, C.M. (Oak Ridge National Lab., TN (USA); Lehigh Univ., Bethlehem, PA (USA). Dept. of Metallurgy and Materials Engineering). 1985. Contract AC05-84OR21400. 15p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016356.

From 3. international aluminum-lithium conference; Oxfordshire, England (9 Jul 1985).

Combined small angle x-ray scattering (SAXS) and transmission electron microscopy (TEM) studies have been performed on two binary Al-Li alloys subjected to different pre-aging treatments. Both the SAXS and TEM data indicate that $\delta$ ($Al_3Li$) in samples of the two alloys directly quenched to the aging temperature is larger in size than in samples quenched to below room temperature prior to aging. SAXS data indicate an initial rise in scattering center size in Al-9.4 at. % Li, or in the TEM studies of $\delta'$ in both alloys. It is considered that these observations are evidence that the initial rise in the SAXS data in Al-9.4 at. % Li alloys is due to a phenomenon other than $\delta'$ precipitation. The possibility of matrix spinodal decomposition in this alloy is one explanation.

**46722 (CONF-850871—5) Coupled electron-nuclear magnetism and neutron diffraction.** Kawarazaki, S.; Arthur, J. (Oak Ridge National Lab., TN (USA); Osaka Univ., Toyonaka (Japan). Dept. of Physics). Jul 1985. Contract AC05-84OR21400. 26p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85016479.

From International conference on neutron scattering; Santa Fe, NM, USA (19 Aug 1985).

It often occurs that, in a rare-earth compound having a singlet electronic ground state, a long-range magnetically ordered state is formed by coupling of the nuclear spins with the electrons through the hyperfine interaction, at millikelvin temperatures. Neutron scattering has been used to measure the details of the magnetization processes of both the electrons and the nuclear spins in the coupled state in $PrSn_3$, $HoVO_4$, and $PrCu_2$. The polarized nuclear spins could be observed through spin dependent nuclear scattering by $^{141}Pr$ and $^{165}Ho$. The experimental results for $PrSn_3$ and $HoVO_4$ can be explained very well based on mean field considerations. For $PrCu_2$, a recent experiment indicates that a sinusoidal screw structure is realized simultaneously both in the electronic and nuclear spin systems of this material.

**46723 (CONF-8111229—, pp vp) Use of Auger electron spectroscopy and ellipsometry in the study of corrosion inhibition.** Lewis, G. (Univ. of Zimbabwe, Salisbury). 1981. National Physical Research Laboratory, CSIR, P.O. Box 395, Pretoria, 0001, South Africa.

From Symposium on surface science and its industrial implications; Pretoria, South Africa (1 Nov 1981).

The techniques of Auger electron spectroscopy and ellipsometry are applied to the study of the surface films formed on copper in aqueous solutions containing an inhibitor, benzimidazole. The results show the surface film to be non-stoichiometric, 64 nm thick, with an approximate composition and optical constant of $Cu_6N_{0.6}O_2$ and 1.50(1 - 0.02i), respectively.

**46724 (CONF-8111229—, pp vp) Kinematics of the structure and morphology during surface reactions between transition metals and molecular hydrogen.** Von Erichsen, L.C.; Meusemann, H.; Haverkamp, H.; Luckner, F.; Maas, A.; Hosseini, S.M.; Urbahn, H. (Univ. of Bonn, Germany). 1981. National Physical Research Laboratory, CSIR, P.O. Box 395, Pretoria, 0001, South Africa.

From Symposium on surface science and its industrial implications; Pretoria, South Africa (1 Nov 1981).

A novel technique characterized by the in-situ SEM observation of interface morphology kinematics is described. Results obtained with hydrogen gas and the transition metals, V, Nb, Ta, Ti, Zr, Hf and Y are presented.

**46725 (CONF-8508107—1) Damage-rate gradient effects on radiation-induced segregation and phase stability in irradiated alloys.** Lam, N.Q.; Okamoto, P.R. (Argonne National Lab., IL (USA)). Jul 1985. Contract W-31-109-ENG-38. 11p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016605.

From International seminar on solute defect interaction: theory and experiment; Kingston, Ontario, Canada (5 Aug 1985).

Recent studies have shown that significant compositional redistribution in irradiated alloys can be induced by the gradients in the atomic displacement rates resulting from nonuniform defect production, in addition to the commonly-observed solute segregation at defect sinks. This process gives rise to complex local phase transformations during light-ion bombardment or irradiation with focused electron beams in the high-voltage electron microscope. Results of our theoretical and experimental investigations of this phenomenon in Ni-Al and Ni-Si are discussed. The implications of the observed effect in a number of areas of materials science are assessed.

**46726 (DOE/ER/10816—T1) Experimental and analytical investigations of creep cavitation in Type 304 stainless steel. Progress report, January 8, 1983-January 7, 1984 .** Delph, T.J.; Fields, R.J. (Lehigh Univ., Bethlehem, PA (USA). Office of Research). 1984. Contract AC01-81ER10816. 53p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85017627.

Focus of the investigation is upon creep cavitation in AISI Type 304 stainless steel under conditions of both uniaxial and multiaxial stress. Experimental work with uniaxial tension specimens is reported in Section II, while progress to date on specimens containing multiaxial stress fields is described in Section III.

**46727 (DOE/OR/21400—T169) Microstructural control to improve the properties of chromium-molybdenum weld metal. Final technical report, October 1, 1983-October 30, 1984.** Pickering, E.W. Jr. (Combustion Engineering, Inc., Chattanooga, TN (USA). Metallurgical and Materials Lab.). 10 Mar 1985. Contract AC05-84OR21400. 36p. (CEMML—64760-13). NTIS, PC A03/MF A01; GPO Dep. File Number DE85016179.

The objective of this work was to formulate and produce a variety of welding consumables for the purpose of determining the effects of compositional and process variables on the microstructure and mechanical properties of shielded metal arc (SMA) weld metal of advanced Cr-Mo steels. Composition variables included the effect of slag basicity and oxygen potential as well as the effect of alloying elements. Welding variables included heat input, preheat and interpass temperature, and post weld heat treatments. Primary work centered on development, and supplying welding consumables, welding of test plates and related testing at both Combustion Engineering (C-E) and the Oak Ridge National Laboratory (ORNL). In addition, two experimental heats of 3Cr-1.5Mo were laboratory manufactured for use by other contractors on the Advanced Fossil Energy Materials Research and Technology Development Program. This report summarizes the work accomplished during the contract period. Electrodes were produced for 3Cr-1.5Mo-V steel with three levels of C and V, and SMA weldments were made in 1-in. thick plates. After a 6-h post weld heat treatment at 700°C the electrode producing the highest deposited C and V (0.1% for each) showed the best strength and impact properties. Additional SMA welds produced with nominal 0.1% C and 0.1% V were tested to examine the influence of post weld heat treatment on strength and Charpy-V impact. These data showed that 3Cr-1.5Mo-V steel can be readily welded by the SMA process and that good strength and toughness will result after post-weld heat treatments in the temperature range 663 to 700°C. Compositions were identified that resulted in improved useability and Charpy V-notch values. 4 figs., 21 tabs.

**46728 (DOE/OR/21400—T171) Weldability of Cr-Mo steels for fossil energy applications.** Lundin, C.D.; Richey, M.W.; Menon, R.; Kruse, B.J.; Henning, J.W. (Tennessee Univ., Knoxville (USA). Welding Research and Engineering). Apr 1984. Contract AC05-84OR21400. 229p. (UTK/FMP—4/84). NTIS, PC A11/MF A01; 1; GPO Dep. File Number DE85016178.

This research program was undertaken to provide fundamental and basic metallurgical information on the behavior of the heat-affect zone (HAZ) in Cr-Mo steel welds, as well as practical information on their relative weldability. The principal work was the evaluation of the stress-relief cracking (SRC) and hydrogen-assisted cracking (HAC) susceptibility of Cr-Mo steels ranging in Cr content from 2 1/4% to 12%. Differences in observed cracking behavior were contrasted with differences in composition, on-cooling transformation behavior and weld microstructure. 86 refs., 106 figs., 12 tabs.

**46729 (EUR—9603-EN) Evaluation of COST project 50 'Materials for gas turbines' and COST project 501 'High temperature materials for conventional systems of energy generation and conversion using fossil fuels'.** Bunk, W.; Bildstein, H.; Costa, P.; Deruyttere, A.; Hart, A.; Kolster, B. (Commission of the European Communities, Luxembourg. Directorate-General for Information, Market and Innovation). 1985. 105p. Commission of the European Communities, Luxembourg. Office of Official Publications of the European Communities.

This evaluation report is the outcome of the deliberations of six external experts designated by the Commission to provide an independent assessment of COST project 50 'High temperature materials for gas turbines' (1972-84) and its follow-up COST project 501, still in progress. In the course of a three-day 'hearing', the panel focused on the appraisal of the value and impact of the projects - taking into account the original objectives contained in the relevant agreement - and in particular on the synergetic effects of this type of European R and D cooperation to progress in an industrial field. The effectiveness of the projects' management structure is also reviewed. The report concludes with a number of recommendations for the future orientation of the project.

**46730 (IAE—3909/10) Electric and magnetic resistance of amorphous and crystalline $Zr_{75}Rh_{25}$, $Zr_{70}Be_{30}$, $Zr_{54}Cu_{46}$ alloys.** Gumbatov, S.G.; Panova, G.Kh.; Shikov, A.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). 1984. 13p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE85702118.

Electric and magnetic resistance of $Zr_{75}Rh_{25}$, $Zr_{70}Be_{30}$, $Zr_{54}Cu_{46}$ alloys in amorphous and metastable crystal state were measured in 2-300 K temperature range and 7.4-20 T magnetic fields. The negative temperature resistance coefficient is observed for amorphous systems. It can be explained by means of Ziman theory, experimental thermodynamic data and roentgenograms obtained for the same samples. The revealed change in temperature dependence of electric resistance is explained satisfactorily resistance is explained satisfactorily by the change of structural factor. Temperature and field dependences of magnetic resistance of investigated alloys were obtained. The value of magnetic resistance is low and is practically independent of field orientation.

**46731 (INFO—0118) Corrosion of steels in sour gas environments.** Twigg, R.J. (Atomic Energy Control Board, Ottawa, Ontario (Canada)). Mar 1984. 178p. NTIS (US Sales Only), PC A09/MF A01. File Number DE85702119.

This report presents a study on the effects of sour gas environments on steels. Emphasis is placed on alloys commonly used in the heavy water, sour gas and refining industries. In addition, 'high strength, low alloy' steels, known as 'oil country tubular goods', are included. Reference is made to the effects of hydrogen sulphide environments on austenitic steels and on certain specialty steels. Theories of hydrogen-related cracking mechanisms are outlined with emphasis placed on sulphide stress cracking and hydrogen induced cracking in carbon and low alloy steels. Methods of controlling sulphide stress cracking and hydrogen induced cracking are addressed separately. Case histories from the heavy water, refining, and sour gas industries are used to illustrate operating experience and failure mechanisms. Finally, recommendations, based largely on the author's industrial experience, are made with respect to quality assurance and inspection requirements for sour service components. Only published literature was surveyed. Abstracts were made of all references, reviewing the major sources in detail.

**46732** (INIS-mf—9742, pp 107-113) **Autoradiographic investigation of antimony distribution in Al-Sb and Cu-Sb alloys.** Gibas, K.; Radwan, M. (Politechnika Poznanska (Poland)). 1983. (In German). NTIS (US Sales Only), PC A12/MF A01. File Number DE85781598. (CONF-8305206—).

From 13. international symposium on autoradiography; Tabor, Czechoslovakia (2 May 1983).

The said alloys were used for verifying the hypothesis that the type of probability distribution of alloy components depends on

the type of their steady state diagram. Given are the steady state diagrams for these alloys, experimental conditions and autoradiograms, and the results of the photometry of the autoradiograms. The statistically processed results of the measurement were compared with the theoretical assumptions. The results of the comparison are not in disagreement with the presented hypothesis. (Ha).

46733 (INIS-mf—9742, pp 127-131) **Autoradiographic investigation of the transport process in W-Ni composite system.** Kozma, L.; Bartha, L. (Research Institute for Technical Physics of the Hungarian Academy of Sciences, Budapest). 1983. NTIS (US Sales Only), PC A12/MF A01. File Number DE85781598. (CONF-8305206—).

From 13. international symposium on autoradiography; Tabor, Czechoslovakia (2 May 1983).

The mechanism of the nickel activated recrystallization of W wire was studied by means of microautoradiographic method. It was found that the activator brought about a new phase at the grain boundaries through which material rearrangement took place. The rate was controlled by the diffusion of tungsten in this new phase. (author).

46734 (INIS-mf—9742, pp 132-139) **Autoradiographic determination of carbon distribution in ferritic-austenitic X5 CrNiTi 26.6 steel.** Dehnke, W.; Boehme, W. (VEB Mansfeld Kombinat Wilhelm Pieck, Freiberg (German Democratic Republic). Forschungsinstitut fuer NE-Metalle). 1983. (In German). NTIS (US Sales Only), PC A12/MF A01. File Number DE85781598. (CONF-8305206—).

From 13. international symposium on autoradiography; Tabor, Czechoslovakia (2 May 1983).

Three heats of steel X5CrNiTi26.6 of different compositions were labelled with $^{14}C$. Specific activity was approximately 75 $MBq.kg^{-1}$ ($2mCi.kg^{-1}$). The castings were forged and rolled into bars 12 mm in diameter. Following diverse heat treatment samples were taken for autoradiography. Macroscopic and microscopic distribution of carbon was then visually and photometrically evaluated. (author).

46735 (INIS-mf—9742, pp 160-167) **Application of track autoradiography method in studying steel recrystallization process.** Firhanek, Ch. (Instytut Metalurgii Zelaza, Gliwice (Poland)). 1983. (In Russian). NTIS (US Sales Only), PC A12/MF A01. File Number DE85781598. (CONF-8305206—).

From 13. international symposium on autoradiography; Tabor, Czechoslovakia (2 May 1983).

Samples of austenitic steels containing 0.002 to 0.004% boron were irradiated in an EVA reactor with a thermal neutron flux density of $5 \times 10^{12}$ $cm^{-2}s^{-1}$. Cellulose nitrate was used as the track detector for autoradiograms. Boron which delineated austenite grains was mostly present in form of carboborides $M_{23}(CB)_6$ with different level of dispersion. Steel deformation during rolling at higher temperatures (above 1000 degC) took place with complete recrystallization of the austenite. At temperatures of 930 to 940 degC a "double" net of grains was observed when it was possible to determine the mutual position of old (after deformation) and new (after heat treatment) grain boundaries. Above this temperature the autoradiograms showed the real structure of the austenite. (E.S.).

46736 **(JAERI-M—84-071) X-ray photoelectron and x-ray-induced Auger electron spectroscopic data, 2. 4d transition-metals (Y, Zr, Nb, Mo, Ru) and related oxides.** Baba, Yuji; Sasaki, Teikichi. (Japan Atomic Energy Research Inst., Tokyo). Apr 1984. 47p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85702055.

The intrinsic data of the X-ray photoelectron spectra (XPS) and X-ray-induced Auger electron spectra (XAES) for 4d transition-metals and related oxides were obtained by means of a spherical electron spectrometer. The metallic surfaces were cleaned by two different methods: mechanical filing and $Ar^+$ ion etching. In the case of the $Ar^+$ ion bombarded Y, Zr, and Nb metals, the binding energies of the core-lines and the kinetic energies of the Auger lines shift from those for the mechanically filed surfaces. The energy shifts were interpreted in terms of the ion-induced lattice distortion of the metal surfaces. The oxides examined are typical compounds such as $Y_2O_3$, $ZrO_2$, $Nb_2O_5$, $MoO_2$ and $RuO_2$. The data consists of 4 wide scans, 33 core-line spectra, 10 valence-band spectra and 12 XAES spectra. The peak positions of the core-lines and the Auger lines were summarized in 6 tables together with their chemical shifts.

46737 **(Juel—1966) Influence of bulk and surface phenomena on hydrogen permeation through metals.** Waelbroeck, F.; Wienhold, P.; Winter, J.; Rota, E.; Bauno, T. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Plasmaphysik). Dec 1984. 201p. B. File Number DE85752235.

We discuss the permeation of hydrogen through metals and alloys such as iron, nickel, steels and Inconel wherein H dissolves endothermically from an $H_2$ gas. We assume first that trapping centers, surface contamination layers, the saturation of the H surface coverage and the implantation profile - when energetic ions drive the permeation - can be neglected, that a quasi-equilibrium exists between the H atom concentration $\nu$ in the adsorbed layer and c in the near surface layers and that the H solubility and diffusivity are homogeneous in the membrane. We evaluate thereafter separately the influence of these various effects and identify the parameter domains where appreciable corrections result. The permeation phenomenon is complex even when these simplifications are made: the penetration rate is proportional to the flux of thermal molecules, atoms or energetic ions - depending upon the case - which strike the surface; the diffusion in the metal is proportional to the gradient of c; the release rate depends on $c^2$; the time-dependent diffusion equation includes a double spatial derivative of c. Permeation can only be fully described when computer codes such as PERI is used. Simple analytical relations are however obtained in several limiting cases. They are the object of this report. Some of them had already been derived by other authors but they were not shown to be part of a single, self consistent permeation model. A comparison of predicted and experimental results shows that the simplified model describes surprisingly accurately the hydrogen exchange between gas and metal solutions.

46738 **(KFKI—1984-94) Amorphous alloys bibliography 1976-1984: papers from the Central Research Institute for Physics (Budapest) and cooperating institutions.** Bakonyi, I. (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics). 1984. 58p. NTIS (US Sales Only), PC A04/MF A01. File Number DE85902006.

In Hungary, the study of amorphous alloys began in the mid 1970s. The project was initiated and organized by the Central Research Institute for Physics (CRIP) of the Hungarian Academy of Sciences. Subsequently, a number of Hungarian institutions joined in the study of glassy metals. Since 1978 a considerable part of the research has been carried out within the framework of various international cooperations. This compilation contains the bibliographical data of 265 papers published on amorphous alloys by researchers of CRIP and 16 Hungarian cooperating institutions. The list of papers is as complete as possible for the years 1976 through 1983 and a preliminary list of papers published or to be published in 1984 is also appended. Papers are in English unless otherwise stated. Indexes are provided.

46739 **(LA-UR—85-2805) Comparison of phosgene, chlorine, and hydrogen chloride as reagents for converting molten $CaO.CaCl_2$ to $CaCl_2$.** Fife, K.W. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 17p. (CONF-851048—5). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85017568.

From 168. meeting of the Electrochemical Society; Las Vegas, NV, USA (13 Oct 1985).

One method at Los Alamos for preparing impure plutonium metal from the impure oxide is by batch reduction with calcium metal at 850°C in a $CaCl_2$ solvent. The solvent salt from this reduction is currently discarded as low-level radioactivity waste only because it is saturated with the CaO byproduct. We have demonstrated a pyrochemical technique for converting the CaO to $CaCl_2$ thereby incorporating solvent recycling into the batch reduction process. We will discuss the effectiveness of HCl, $Cl_2$, and $COCl_2$ as chlorinating agents and recycling actual spent process solvent salts. 6 refs., 8 figs.

**46740 (LA-UR—85-2821) Temperature kinetics during shock-wave consolidation of metallic powders.** Schwarz, R.B.; Kasiraj, P.; Vreeland, T. Jr. (Los Alamos National Lab., NM (USA); IBM Research Div., San Jose, CA (USA); California Inst. of Tech., Pasadena (USA)). 1985. Contract W-7405-ENG-36. 17p. (CONF-850770—9). NTIS, PC A02/MF A01; GPO Dep. File Number DE85017567.

From EXPLOMET '85 - international conference on metallurgical applications of shock wave and high strain-rate phenomena; Portland, OR, USA (28 Jul 1985).

Powders (60 μm diam) of constantan and pure copper were compressed statically into cylindrical greens (20.3 mm diam, 5.3 mm long) with a flat interface separating the two powders. A 20-mm propellant gun was used to accelerate a flyer of Lexan, copper, or aluminum, and generate in the green a shock wave with front parallel to the Cu/constantan interface. The voltages between opposite ends of the greens were measured as a function of time and for shock pressures between 1.3 and 9.4 GPa. When the shock wave arrives at the Cu/constantan interface, the voltage signal shows an abrupt increase, which lasts between 45 and 81 ns and leads to a peak temperature T/sub p/. After this, the hotter and cooler parts of the compact equilibrate and the temperature decreases to a value T/sub h/. With increasing shock pressure, T/sub h/ increases from 425 to 1215 K. The measurements of T/sub h/ are in excellent agreement with the temperatures calculated from the measured flyer velocity, the Hugoniot for copper powder, and thermodynamic data for the flyer and powders.

**46741 (LA-UR—85-2861) Self-consistent electronic structure of alpha-phase Hume-Rothery electron compound alloys Cu/sub c/Zn/sub 1-c/, Cu/sub c/Ga/sub 1-c/, and Cu/sub c/Ge/sub 1-c/.** Stocks, G.M.; Boring, A.M.; Nicholson, D.M.; Pinski, F.J.; Johnson, D.D.; Faulkner, J.S.; Gyorffy, G.L. (Oak Ridge National Lab., TN (USA); Los Alamos National Lab., NM (USA); Tennessee Univ., Knoxville (USA); Cincinnati Univ., OH (USA); Bristol Univ. (UK)). 1985. Contract AC05-84OR21400;W-7405-ENG-36. 22p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85017560.

We have performed charge self-consistent electronic structure calculations for the α-phase Hume-Rothery electron compound alloys Cu/sub c/Zn/sub 1-c/, Cu/sub c/Ga/sub 1-c/, and Cu/sub c/Ge/sub 1-c/ having electron to atom ratios 1:1, 1:2, and 1:3 for each alloy series. The calculations are based on the self-consistent-field Korringa-Kohn-Rostoker coherent-potential approximation (KKR-CPA). We show results for the densities of states and Fermi surface of these alloys; the behavior of these quantities is quite different from that predicted on the basis of the rigid band model. We also show results for the ground state properties of the Cu/sub c/Zn/sub 1-c/ alloys that were obtained on the basis of a recent generalization of the density functional theory to random alloys. The theory provides a basis for understanding the concentration variation of the lattice parameter (Vegards' Law) of Cu/sub c/Zn/sub 1-c/ alloys at the microscopic quantum mechanical level.

**46742 (LA-UR—85-2902) Metal film deposition by laser breakdown chemical vapor deposition.** Jervis, T.R. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 39p. (CONF-8509150—1). NTIS, PC A03/MF A01; GPO Dep. File Number DE85017554.

From NATO advanced study institute; San Mianiato, Italy (2 Sep 1985).

Dielectric breakdown of gas mixtures can be used to deposit homogeneous thin films by chemical vapor deposition with appropriate control of flow and pressure conditions to suppress gas phase nucleation and particle formation. Using a pulsed $CO_2$ laser operating at 10.6 microns where there is no significant resonant absorption in any of the source gases, we have succeeded in depositing homogeneous films from several gas phase precursors by gas phase laser pyrolysis. Nickel and molybdenum from the respective carbonyls and tungsten from the hexafluoride have been examined to date. In each case the gas precursor is buffered to reduce the partial pressure of the reactants and to induce breakdown. The films are spectrally reflective and uniform over a large area. Films have been characterized by Auger electron spectroscopy, x-ray diffraction, pull tests, and resistivity measurements. The highest quality films have resulted from the nickel depositions. Detailed x-ray diffraction analysis of these films yields a very small domain size (~ 50 A) consistent with rapid quenching from the gas phase reaction zone. This analysis also shows nickel carbide formation consistent with the temperature of the reaction zone and the Auger electron spectroscopy results which show some carbon and oxygen incorporation (8% and 1% respectively). Gas phase transport and condensation of the molybdenum carbonyl results in substantial carbon and oxygen contamination of the molybdenum films requiring heated substrates, a requirement not consistent with the goals of the program to maximize the quench rate of the deposition. Results from tungsten deposition experiments representing a reduction chemistry instead of the decomposition chemistry involved in the carbonyl experiments are also reported.

**46743 (LA-UR—85-2920) Structural examination of iridium-based single-crystal preparations.** Axler, K.M.; Roof, R.B. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 5p. (CONF-8508118—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85017550.

From 34. Denver X-ray conference; Denver, CO, USA (1 Aug 1985).

A high-temperature crystal growth experiment produced discrete single-crystal products of AlIr and IrSi. The preparation and examination of these phases is described within. This project is part of a materials compatibility study relating to radioisotopic heat sources. These heat sources are comprised of a $PuO_2$ fuel pellet encapsulated in an Ir alloy containment shell. Th is introduced as an additive within the Ir to maintain ductility. Si and P are picked up inadvertently in the fuel processing. The compatibility of the heat sources with Al is of interest because of potential interactions with Al alloy hardware associated with the heat source environment.

**46744 (LA-UR—85-3026) High strain rate deformation in FCC metals and alloys.** Follansbee, P.S. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 34p. (CONF-850770—8). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85017533.

From EXPLOMET '85 - international conference on metallurgical applications of shock wave and high strain-rate phenomena; Portland, OR, USA (28 Jul 1985).

The effect of strain rate, and particularly of high strain rates, on deformation mechanisms in materials is of fundamental interest to those who model and analyze dynamic loading. In many materials the strain rate sensitivity is known to increase dramatically when the strain rate is raised above $\sim 10^3\ s^{-1}$. This increase has been interpreted previously as a transmission in deformation mechanism from thermal activation control at low strain rate to dislocation drag control at high strain rate. In copper, copper-aluminum alloys and stainless steel, recent measurements have shown that the increased rate sensitivity found at high strain rates is not due to a transition in deformation mechanism but rather can be explained with standard thermal activation theory. These findings and their implications regarding the formulation of constitutive behavior are presented.

**46745 (LBL—19236) Thermomechanical processing of a two-phase Al-Cu-Li-Zr alloy.** Glazer, J.; Morris, J.W. Jr. (Lawrence Berkeley Lab., CA (USA); California Univ., Berkeley (USA). Dept. of Materials Science and Mineral Engineering). Jun 1985. Contract AC03-76SF00098. 19p. (CONF-850777—3). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85017644.

From 3. international aluminum-lithium conference; Oxfordshire, England (9 Jul 1985).

The effect of large second-phase particles on the workability, mechanical properties, and response to thermochemical processing of an Al-2.49Cu-2.37Li-0.13Zr alloy was investigated. The solution-treated alloy was compared with a dispersoid-containing alloy fabricated by aging the base alloy at an intermediate temperature to bring out second-phase particles. Extensive deformation and short heat treatments that cause some of the solute to be incorporated into dispersoid particles were both found to be beneficial to the mechanical properties of the alloy. In specimens which failed intergranularly, the presence of dispersoid particles did not significantly affect the fracture properties.

**46746 (LBL—19962) Study of hydrogen embrittlement in lath martensitic steels.** Kim, Y.H. (Lawrence Berkeley Lab., CA (USA)). Jun 1985. Contract AC03-76SF00098. 123p. NTIS, PC A06/MF A01; GPO Dep. File Number DE85017651.

Thesis.

Hydrogen assisted brittle fracture has been characterized in lath martensitic steels. Fracture modes in hydrogen assisted brittle fracture can be divided into three types: intergranular, brittle transgranular, and dimple rupture. Hydrogen assisted intergranular fracture and transgranular brittle fracture were the main interests of this study since these two brittle fracture modes control susceptibility to hydrogen embrittlement. The sources of metallurgical flaws which result in brittle fracture were identified and modifications to overcome these flaws are suggested. 154 refs., 60 figs.

**46747 (LBL—20011) High temperature corrosion of iron-chromium alloys in sulfur-containing atmospheres.** Choi, S.H. (Lawrence Berkeley Lab., CA (USA)). Jul 1985. Contract AC03-76SF00098. 176p. NTIS, PC A09/MF A01; 1; GPO Dep. File Number DE85017655.

The corrosion behavior of iron-chromium alloys in sulfur-containing environments has been studied in controlled oxygen and sulfur partial pressures. The partial pressures were chosen to simulate the sulfur and oxygen activities in low-oxygen partial pressure locations such as those in fluidized bed combustors. The high-temperature metal surfaces are covered with a calcium sulfate deposit. It was found that the calcium sulfate coupled with local low oxygen activities induces sulfidation/oxidation corrosion. Although the sulfur activity in the atmosphere is important in determining whether or not sulfidation/oxidation corrosion took place, the development of the attack is much more sensitive to the actual $SO_2$ partial pressure. Discrete internal Cr-rich sulfide particles were formed in the underlying alloy below an inner Cr-rich oxide layer. The development of internal sulfides is followed by in-situ internal oxidation of the sulfides, instability of the interface between the scale and alloy, leading to the incorporation of fragments of the more noble metallic constituents in the scale, and finally the destruction of the ability of the alloy to regenerate the protective oxide. The reaction kinetics associated with this morphological development are of the breakaway type. Sulfidation/oxidation is a breakaway process. After breakaway, the metal oxidizes to form a non-protective characteristic two-layer oxide scale. It is shown that the breakaway can be correlated with the develoment of a "critical microstructure". The potential benefit of such an identification is that the prospect of breakaway can be identified by microstructural studies of specimens corroded for relatively short times, and may allow for quantitative modelling of breakaway.

**46748 (NBSIR—84-2959) Corrosion of materials used in steam generating boiler systems. Final report.** Escalante, E.; Mathews, D.; Fink, J. (National Bureau of Standards, Washington, DC (USA). Metallurgy Div.). Oct 1984. Contract AT01-79CS20528. 50p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85017205.

Five alloys, SA178, SA192, SA213-T11, SA213-T22, and Type 304 Stainless Steel, were evaluated on their resistance to pitting in a coal burning boiler and in a residential refuse burning incinerator. The materials were introduced into the vicinity of the boiler tubes using a probe whose temperature was controlled and monitored to simulate conditions of the boiler tubes. After three to six months, the probes were withdrawn and the alloy specimens removed for evaluation. The data indicate that the environment of the refuse burning incinerator was considerably more aggressive than that of the coal burning boiler. Chloride was found in practically all the pits examined in the alloys from the refuse burning system, but no chloride was found in the pits examined on the materials exposed in the coal burning boiler. The data suggest that the moisture from lawn clippings increases the rate of attack which is further aggravated by large temperature fluctuations. Type 304 stainless steel was the most resistant to pitting in both environments, but the SA213-T11 and SA213-T22 were less resistant to pitting than the lower alloy SA178 and SA192 in the refuse burning incinerator.

**46749 (ND-R—930(S)) Variation in the strain anisotropy of Zircaloy with temperature and strain.** Hindle, E.D.; Worswick, D. (UKAEA Risley Nuclear Power Development Establishment). Apr 1984. 36p. (PWR/FBWG/P—83-142). NTIS (US Sales Only), PC A03/MF A01. File Number DE85702116.

Strain anisotropy was investigated at temperatures in the range 293 to 1117K in circular tensile specimens prepared from rolled Zircaloy-2 plate so that their tensile axes were parallel to and transverse to the rolling direction. The strain anisotropy factor for both types of specimen increased markedly in the high alpha phase region above 923K reaching a maximum at circa 1070K. Above this temperature in the alpha-plus-beta phase region the strain anisotropy decreased rapidly as the proportion of beta phase increased and was almost non-existent at 1173K. The strain anisotropy was markedly strain dependent, particularly in the high alpha phase region. The study was extended to Zircaloy-4 pressurized water reactor (PWR) 17 x 17 type fuel rod tubing specimens which were strained under biaxial conditions using cooling conditions which promoted uniform diametral strain over most of their lengths (circa 250 mm). In these circumstances the strain anisotropy is manifest by a reduction in length. Measurement of this change along with that in diameter and wall thickness produced data from which the strain anisotropy factor was calculated. The results, although influenced by additional factors discussed in the paper, were similar to those observed in the uniaxial Zircaloy-2 tensile tests.

**46750 (NP—5770368) Crack initiation and propagation in a forged nickel-base alloy under high mechanical and thermal loading.** Scarlin, R.B. (Brown, Boveri und Co. Ltd., Baden (Switzerland). Central Lab.). Dec 1982. 63p. NTIS (US Sales Only), PC A04/MF A01. File Number DE85770368.

The aim of the present work was the determination of the relevant mechanical properties (including fracture toughness, creep, high cycle fatigue and low cycle fatigue) of a commercially produced forging of the diameter required for a large industrial gas turbine. All specimens used in the present testing programme were machined from Nimonic 901 forging supplied by Roechling, Voelklingen, in the form of a circular disc of diameter 967 mm and length 234 mm. Test methods and results are presented for the work carried out using conventional smooth and notched round specimens and then for precracked fracture mechanics testpieces.

**46751 (ORNL/TM—9646) Corrosion of materials in absorption heating and refrigeration fluids.** Griess, J.C.; DeVan, J.H.; Perez Blanco, H. (Oak Ridge National Lab., TN (USA)). Jun 1985. Contract AC05-84OR21400. 15p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85018140.

The corrosion of metals and alloys in absorption refrigeration fluids has received little attention except for the behavior of steel and copper alloys in aqueous lithium bromide solutions. This report presents results of short-term corrosion tests on several materials in lithium bromide solutions as well as in other fluids of potential interest in advanced absorption machines. All materials tested had extremely high resistance to organic fluids, but in the aqueous systems some of the materials underwent localized attack. Type 304 stainless steel had acceptable corrosion resistance in most environments, but it underwent stress corrosion cracking in oxygen- or chromate-containing lithium bromide and even in the unstressed condition was subject to intergranular attack in hot concentrated caustic solutions. 10 refs., 2 figs., 4 tabs.

**46752 (PNL-SA—12996) Some radiation damage-stress corrosion synergisms in austenitic stainless steel.** Jones, R.H. (Pacific Northwest Labs., Richland, WA (USA)). Feb 1985. Contract AC06-76RL01830. 7p. (CONF-850902—4). NTIS, PC A02/MF A01; GPO Dep. File Number DE85017911.

From 2. international symposium on environmental degradation of materials in nuclear power systems--water reactors; Monterey, CA, USA (9 Sep 1985).

Since radiolytic effects on stress corrosion cracking does not appear to be a major concern, an assessment of the effect of radiation induced microstructure and microchemistry changes on stress corrosion has been undertaken. The results of two of these evalua-

tions: (1) radiation enhanced creep effects on crack growth rates; and (2) radiation enhanced grain boundary P segregation and IGSCC are reported in this paper.

**46753 (RISO-R—506) Diffraction studies of ordered phases and phase transitions. A synchrotron X-ray scattering study of monolayers of $CF_4$ adsorbed on graphite and a neutron scattering study of the diluted uniaxial dipolar coupled ferromagnets LiTbsub(.3)Ysub(.7)$F_4$ and LiHosub(.3)Ysub(.7)$F_4$.** Kjaer, K. (Risoe National Lab., Roskilde (Denmark)). Aug 1984. 177p. NTIS (US Sales Only), PC A09/MF A01. File Number DE85702121.

Two investigations are reported here. First, monolayers of $CF_4$ physisorbed on the (001) face of graphite have been studied by means of X-ray diffraction experiments carried out at the electron storage ring DORIS in Hamburg. The exfoliated graphite substrate UCAR-ZYX was used in order to obtain a large area for adsorption and hence a large sample. Four two-dimensional solid phases of the $CF_4$ films were seen, including a structure which is 2 x 2 commensurate relative to the substrate. On compression (by variation of coverage or temperature), this phase transforms to a uniaxially compressed structure ('stripe' phase). Further, at higher coverages a hexagonal structure was seen, incommensurate relative to the substrate, and at low temperatures and coverages, a complicated structure emerged, giving three close diffraction peaks in the powder pattern. Data are presented characterizing the melting and commensurate to incommensurate transitions. Complementary to the synchrotron X-ray data, a presentation of the theory of synchrotron radiation is given. The second investigation was of the ferromagnetic phase transitions in the randomly diluted, dipolar coupled uniaxial ferromagnets LiTbsub(.3) Ysub(.7)$F_4$ and LiHosub(.3) Ysub(.7)$F_4$ by neutron diffraction at the RIS0 DR 3 reactor.

**46754 (SAND—85-0322C) Dynamic shock studies of vanadium.** Chhabildas, L.C.; Hills, C.R. (Sandia National Labs., Albuquerque, NM (USA)). 1985. Contract AC04-76DP00789. 27p. (CONF-850770—7). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85017381.

From EXPLOMET '85 - international conference on metallurgical applications of shock wave and high strain-rate phenomena; Portland, OR, USA (28 Jul 1985).

Using gas-gun loading techniques and velocity interferometric techniques, time-resolved wave profiles have been obtained in vanadium over the stress range of 2.9 to 9.7 GPa. The risetime data indicate steepened shock structures with increasing shock amplitude. However, unlike aluminum, finite risetimes are determined even at 9.7 GPa, indicating a large effective viscosity for the material. The dynamic yield strength measured at the Hugoniot elastic limit is 0.8 GPa and is approximately twice the static yield strength. Material softening is evidenced through measurements of shock velocity and yield strength determinations in the shocked state. The yield strength of the material upon release from the shocked state is estimated to be ~0.43 GPa and is comparable to the static yield strength. Strain-rate dependent processes may be responsible for a higher elastic shear stress sustained before relaxation to an equilibrium value. The primary mode of deformation in shocked vanadium appears to be cross slip, resulting in dislocation tangles. Deformation twins are also observed in shock-recovered specimens with an increasing number with increased shock stress. The thermal diffusivity for vanadium is low, and the shear-strength loss observed in this material is consistent with the strength loss observed for other materials which also have low thermal diffusivities. It is conceivable that the loss of shear strength may be due to long thermal recovery times resulting from inhomogeneous deformation process.

**46755 (SAND—85-0485C) Observations on the shock-synthesis of intermetallic compounds.** Horie, Y.; Graham, R.A.; Simonsen, I.K. (Sandia National Labs., Albuquerque, NM (USA)). 1985. Contract AC04-76DP00789. 16p. (CONF-850770—6). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85016815.

From EXPLOMET '85 - international conference on metallurgical applications of shock wave and high strain-rate phenomena; Portland, OR, USA (28 Jul 1985).

Recent studies of chemical reactions under high pressure shock loading involved exothermic binary metallic systems, Ni-Al and Ti-Al. These studies have shown a complex array of simultaneous processes occurring prior to and during the shock pulse induced chemical reactions. This paper examines selected events thought to be important in the shock compression synthesis as shown by optical micrographs in conjunction with x-ray diffraction and electron probe microanalysis. The emphasis in this paper is placed on highlighting mechanisms that are influenced by material properties and configuration.

**46756 (SAND—85-0757) Oxidation/sulfidation of material candidates for distributed solar receiver thermochemical transport program in $SO_2/O_2$.** Weirick, L.J. (Sandia National Labs., Albuquerque, NM (USA)). Jun 1985. Contract AC04-76DP00789. 35p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85017391.

Metals for potential use in the dissociator and the synthesizer reactors of a distributed solar receiver thermochemical transport loop utilizing $SO_3/SO_2/O_2$ molecular chemistry were tested in $SO_2/O_2$ mixtures at 500°C and 900°C, respectively, for times of up to four weeks. They included titanium, aluminum and nickel, and iron-base, nickel-base and cobalt-base superalloys. Weight gain measurements determine the oxidation/sulfidation kinetics. Electron microprobe analysis identifies any possible penetration of oxygen and sulfur into the metal and the formation of internal oxides and sulfides. The most promising candidates as a result of these tests are the cobalt-base superalloys.

**46757 (SAND—85-1509C) Vacuum arc remelting: an overview.** Zanner, F.J.; Bertram, L.A. (Sandia National Labs., Albuquerque, NM (USA)). 1985. Contract AC04-76DP00789. 41p. (CONF-8509136—1). NTIS, PC A03/MF A01; GPO Dep. File Number DE85016458.

From 8. international conference on vacuum art metallurgy; Linz, Austria (30 Sep 1985).

Vacuum arc remelting (VAR) is a casting process for producing uniform ingots. This paper discusses: arc physics and behavior, metal transfer and electrode gap measurement, boundary conditions on crucible wall, and pool dynamics and macrosegregation. Materials discussed are Inconel 718 and U-6% Nb alloy. 47 refs., 20 figs. (DLC)

**46758 (SAND—85-1687C) Auger electron spectroscopy studies of boron carbide.** Madden, H.H.; Nelson, G.C.; Wallace, W.O. (Sandia National Labs., Albuquerque, NM (USA)). 1985. Contract AC04-76DP00789. 11p. (CONF-850786—2). NTIS, PC A02/MF A01; GPO Dep. File Number DE85017428.

From International conference on the physics and chemistry of boron and boron-rich borides; Albuquerque, NM, USA (29 Jul 1985).

Auger electron spectroscopy has been used to probe the electronic structure of ion bombardment (IB) cleaned surfaces of $B_9C$ and $B_4C$ samples. The shapes of the B-KVV and C-KVV Auger lines were found to be relatively insensitive to the bulk stoichiometry of the samples. This indicates that the local chemical environments surrounding B and C atoms, respectively, on the surfaces of the IB cleaned samples do not change appreciably in going from $B_9C$ to $B_4C$. Fracturing the sample in situ is a way of producing a "clean" representative internal surface to compare with the IB surfaces. Micro-beam techniques have been used to study a fracture surface of the $B_9C$ material with greater spatial resolution than in our studies of IB surfaces. The $B_9C$ fracture surface was not homogeneous and contained both C-rich and B-rich regions. The C-KVV line for the C-rich regions was graphitic in shape. Much of the C-rich regions was found by IB to be less than 100 nm in thickness. The C-KVV line from the B-rich regions was carbidic and did not differ appreciably in shape from those recorded for the IB cleaned surfaces.

**46759 (SKI-B—42-83) Warm pre-stressing, preliminary experiments.** Hedner, G. (Swedish Nuclear Power Inspectorate, Stockholm; Royal Inst. of Tech., Stockholm (Sweden). Dept. of Strength of Materials and Solid Mechanics). Sep 1984. 29p. (TRITA-HFL—52). NTIS (US Sales Only), PC A03/MF A01. File Number DE85702117.

The beneficial effect of warm pre-stressing, WPS, on apparent fracture thoughness at low temperature is well established. Tests are usually performed with constant load during the cooling part of the load cycle. In practice load variations may occur during this part. The present paper reports a preliminary study of the influence of superimposed fatigue loads. It is found that if crack propagation occurs during cooling+fatigue loading, then the maximum load during the fatigue load cycle is the preload to be used for WPS consideration. A few tests were preformed to study the effect of preload reversal. Tensile preload was followed by a compressive load and after unloading the specimens were cooled and fractured. It was found that for the high preload level used in the tests, the beneficial effect of the tensile preload could be totally annihilated by the compressive preload.

46760 **(SLAC-PUB—3512-Rev.) Valence band XPS-study of Fe(100) at finite temperatures. Revision.** Kirby, R.E.; Kisker, E.; King, F.K.; Gurr, D.; Garwin, E.L. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Jul 1985. Contract AC03-76SF00515. 16p. (CONF-841184—33-Rev.). NTIS, PC A02/MF A01; GPO Dep. File Number DE85015754.

From 30. annual conference on magnetism and magnetic materials; San Diego, CA, USA (27 Nov 1984).

Measuring the valence band density of states (DOS) of Fe provides a stringent test of models of metallic ferromagnetism at finite temperatures. The density of states of Fe above the Curie temperature T/sub c/, as obtained by self-consistent calculations in the disordered local moment (DLM) picture by Oguchi et al., and by Pindor et al., differs strongly from the T=0 DOS calculated by Moruzzi et al., between the Fermi energy and 2 eV binding energy, i.e., the relatively broad peak in the T=0 DOS around 1 eV binding energy is of much smaller amplitude in the T > T/sub c/ DOS. This effect should be observable by valence band XPS on Fe as a 30% decrease of intensity at about 1 eV binding energy with a typical energy resolution of about 0.8 eV. The authors have measured the valence band XPS of Fe(100) at room temperature and temperatures above T/sub c/. The predicted intensity decrease has not been observed.

46761 **(UCRL—93132) Creep of 304 LN and 316 L stainless steels at cryogenic temperatures.** Roth, L.D.; Manhardt, A.E.; Dalder, E.N.C.; Kershaw, R.P. Jr. (Westinghouse Research and Development Center, Pittsburgh, PA (USA); Lawrence Livermore National Lab., CA (USA)). 7 Aug 1985. Contract W-7405-ENG-48. 9p. (CONF-850814—2). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85016523.

From Cryogenic engineering conference and international cryogenic materials conference; Boston, MA, USA (12 Aug 1985).

Creep behavior of Type 304 LN plate and 316 L shielded-metal-arc (SMA)-deposited stainless weld metal was investigated at 4°K. Testing was performed at constant load in a creep machine with a cryostat designed for long-term stability. Both transient and steady-state creep were observed during tests lasting over 2000 hours. Steady-state creep rates were much greater than expected from extrapolations of 300-K creep data. Creep rates on the order of $10^{-10}$ $s^{-1}$ were observed at stresses around the yield stress for both materials. The stress exponent under these conditions if ~2.3. Possible creep mechanisms at this temperature and the impact of these results on the design of engineering structures for long-term structural stability at cryogenic temperatures are discussed.

46762 **Evolution of the Pt conduction band in a solid Xe layer.** Raaen, S.; Strongin, M. (Physics Department, Brookhaven National Laboratory, Upton, New York 11973). *Physical Review [Section] B: Condensed Matter;* **32**: No. 6, 4289-4291(15 Sep 1985). Contract AC02-76CH00016.

A photoemission study of the growth of Pt clusters in a solid Xe layer condensed onto a metallic substrate is presented. The evolution of the Pt conduction band is monitored in great detail. Simultaneously, the Xe emission is recorded and changes are correlated with the growth of the Pt band. It is argued that the energy position of the dilute-limit Pt emission tracks the change in substrate work function, which shows that Pt is referenced to the local vacuum level in the atomic limit. Finally, effects of interactions between Pt clusters and substrate are found to depend on the work function and band structure of the substrate employed.

46763 **Competing phases and critical fluctuations at the onset of helical order in Gdsub(1-x)Ysub(x) single crystals.** Sousa, J.B.; Moreira, J.M.; Braga, M.E. (Porto Univ. (Portugal). Centro de Fisica); Palmer, S.B.; Bates, S. (Hull Univ. (UK). Dept. of Applied Physics); Beaudry, B.J. (Ames Lab., IA (USA)). *Journal of Physics F: Metal Physics;* **15**: No. 5, 1171-1177(May 1985).

High-resolution electrical resistivity data (rho,drho/dT) revealed a fascinating succession of fluctuating modes and magnetic phases in Gdsub(1-x)Ysub(x) crystals at the onset of helimagnetism (xsub(c)approx. 0.3). An improved magnetic phase diagram is proposed which contains two multicritical points near xsub(c). Our data refute the suggested existence of a Lifshitz point in Gdsub(1-x)Ysub(x) at x approx. 0.3, i.e. the coexistence of ferromagnetic, paramagnetic and helimagnetic (q→O) phases.

46764 **Molecular-orbital models of the $\alpha$-$\gamma$ transformation of cerium.** Eberhart, M.E. (Los Alamos National Lab., NM (USA); Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Materials Science and Engineering). *Solid State Communications;* **54**: No. 2, 187-191(Apr 1985).

Self-consistent-field Xα scattered-wave molecular-orbital calculations have been performed on clusters modeling the isostructural $\alpha$-$\gamma$ transformation of cerium. The results of these calculations suggest that this transformation is the result of a Jahn-Teller instability.

46765 **Ion-beam- and laser-induced surface modifications.** Appleton, B.R.; Sartwell, B.; Peercy, P.S.; Schaefer, R.; Osgood, R. (Oak Ridge National Lab., TN). *Materials Science and Engineering;* **70**: 23-51(Apr 1985).

It is well established that the properties of the near surface region of materials can determine the performance of a material in many technological applications. The capabilities of energetic ion beam and laser processing of surfaces are reviewed. Ion implantation doping, ion beam mixing, and laser and electron beam processing techniques are capable of producing new and often unique surface properties. The inherent control of these techniques has led to significant advances in our ability to tailor the properties of solids for a wide range of technological applications. Equally important, these techniques have allowed tests of fundamental materials interactions under conditions not heretofore achievable and have resulted in increased understanding of a broad range of materials phenomena. These include new metastable phase formation, rapid nucleation and crystal growth kinetics, amorphous metals and metallic glasses, substitutional alloys, interface interactions, solute trapping, laser-assisted chemical modifications, and a host of others.

46766 **Properties of coated and modified surfaces.** Mattox, D.M.; Greene, J.E.; Buckley, D.H.; Somorjai, G.A. (Sandia National Labs., Albuquerque, NM). *Materials Science and Engineering;* **70**: 79-89(Apr 1985).

The ability to create surface and near-surface properties by coating or surface modification techniques is an important new dimension in the engineering usage of materials. Since the material that is formed by the coating and/or modification process is often unique to the process conditions, the understanding and control of processes are of basic concern in the subject of coating and surface modification technologies and may eventually allow the controlled variation of properties. Four areas of interest are addressed. As an example of how process development can be utilized to control material properties, low energy particle bombardment effects on surfaces and deposited films are discussed. Surface modification and coatings in tribology and ion-surface interactions in semiconductor film growth are then discussed. Finally, some of the recent findings in surface science are discussed as examples of the potential application of ion-surface interactions to generate new properties.

46767 **Interpretation of Q* in thermotransport.** Smith, J.F.; Peterson, D.T. (Ames Lab., IA (USA)); Smith, M.F. (Sandia National Labs., Albuquerque, NM (USA)). *Journal of the Less-Common Metals;* **106**: No. 1, 19-26(Mar 1985).

The heat Q* of transport for the thermotransport of interstitial atoms is resolved into two contributions, one being the activation energy for diffusion and the other arising from an induced biasing of the solute atom jumping by a temperature gradient. The approximation is made that the activation energy for diffusion is negligibly temperature dependent but is the dominant energy barrier to the jumping of solute atoms. Comparison of this interpretation with experimental data indicates that rarely, if ever, is the intrinsic mechanism for thermal transport the sole operating mechanism. The data imply that any single mechanism that can explain the results must be rather complex or, alternatively, that simultaneous operation of two or more mechanisms must be invoked. Data are shown for the thermotransport and diffusion of hydrogen isotopes in vanadium, niobium and tantalum.

46768 **Synthesis of new amorphous metallic spin glasses.** Haushalter, R.C. (to Dept. of Energy). US Patent Application 6-700,845. 11 Feb 1985. 9p. Contract W-31-109-ENG-38. DE85017800 NTIS, PC A02/MF A01; GPO Dep. File Number DE85017800.

Disclosed are: amorphous metallic precipitates having the formula $(M_1)$/sub a/$(M_2)$/sub b/ wherein $M_1$ is at least one transition metal, $M_2$ is at least one main group metal and the integers "a" and "b" provide stoichiometric balance; the precipitates having a degree of local order characteristic of chemical compounds from the precipitation process and useful electrical and mechanical properties.

46769 **Process for forming unusually strong joints between metals and ceramics by brazing at temperatures that do not exceed 750°C.** Hammond, J.P.; David, S.A.; Woodhouse, J.J. (to Dept. of Energy). US Patent Application 6-677,955. 4 Dec 1984. 19p. Contract AC05-84OR21400. DE85017731 NTIS, PC A02/MF A01; GPO Dep. File Number DE85017731.

This invention is a process for joining metals to ceramics to form very strong bonds using low brazing temperature, i.e., less than 750°C, and particularly for joining nodular cast iron to partially stabilized zirconia. The process provides that the ceramic be coated with an active metal, such as titanium, that can form an intermetallic with a low melting point brazing alloy such as 60Ag-30Cu-10Sn. The nodular cast iron is coated with a noncarbon containing metal, such as copper, to prevent carbon in the nodular cast iron from dissolving in the brazing alloy. These coated surfaces can be brazed together with the brazing alloy between at less than 750°C to form a very strong joint. An even stronger bond can be formed if a transition piece is used between the metal and ceramic. It is preferred for the transition piece to have a coefficient of thermal expansion compatible with the coefficient of thermal expansion of the ceramic, such as titanium.

46770 **Preparing reflective substrate surfaces for laser treatment.** Flick, F.F. (to Dept. of Energy). US Patent Application 6-673,970. 21 Nov 1984. 7p. Contract W-7405-ENG-36. DE85017774 NTIS, PC A02/MF A01; GPO Dep. File Number DE85017774.

A coating of either copper oxide or felt tip pen ink is used on reflective copper or gold substrates to enhance laser beam coupling when the substrates are cut or welded with a laser.

46771 **Handbook on the physics and chemistry of the actinides. Vol. 1.** Freeman, A.J.; Lander, G.H. (eds.). Amsterdam, Netherlands; North-Holland (1984). 520p.

Includes subject index.

It is the purpose of this Handbook to describe in detail the present understanding of the actinides by means of comprehensive, critical, broad and up to date reviews covering both the physics and chemistry of these exotic elements. The chapters serve as an introduction to the subject for the non-specialist, as a convenient reference work for the specialist, and as guides for charting pathways for future research. The rapid accelerated pace of research in the last decade continues and carries with it new vigor, ferment, and excitement to a field in a state of transition. In this volume some aspects of the physics of the actinides are reviewed: atomic properties, sample preparation and crystal growth, electronic structure and bulk ground state properties, electron spectroscopy, optical and magneto-optical properties, and neutron elastic scattering.

46772 **Neutron elastic scattering of the actinides. Chapter 6.** Rossat-Mignod, J.; Burlet, P. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France). Dept. de Recherche Fondamentale); Lander, G.H. (Argonne National Lab., IL (USA)). pp 415-512 of Handbook on the physics and chemistry of the actinides. Vol. 1. Freeman, A.J. (Northwestern Univ., Evanston, IL (USA). Dept. of Physics and Astronomy); Lander, G.H. (Argonne National Lab., IL (USA)) (eds.). Amsterdam, Netherlands; North-Holland (1984).

Includes subject index.

Actinide research and neutron scattering both originate primarily from the same source - the control and understanding of nuclear fission. Neutron scattering has now become one of the most versatile microscopic probes in investigations of condensed matter. From the magnetic interaction one can deduce what is probably the most valuable information derived from neutrons on actinide systems: the arrangements, spatial extent, interaction, and dynamical properties of the unpaired electrons. Since these electrons are predominantly 5f (and possibly 6d) and because they are in the outermost shells, they play a crucial role in determining the bonding and solid-state properties of the material. A large part of this chapter is concerned with these studies and their role in increasing our understanding of actinides in general. The object in this review is to cover a number of examples of how neutron elastic scattering has increased our understanding of the actinides.

46773 **Optical and magneto-optical properties. Chapter 5.** Schoenes, J. (Eidgenoessische Technische Hochschule, Zurich (Switzerland). Lab. fuer Festkoerperphysik). pp 341-413 of Handbook on the physics and chemistry of the actinides. Vol. 1. Freeman, A.J. (Northwestern Univ., Evanston, IL (USA). Dept. of Physics and Astronomy); Lander, G.H. (Argonne National Lab., IL (USA)) (eds.). Amsterdam, Netherlands; North-Holland (1984).

Includes subject index.

The author presents a review on the optical properties of the actinides restricted to those optical results which are most relevant for the solid state properties of concentrated actinide systems. On the other hand, he presents as many optical techniques as possible, i.e, to discuss not only absorption and reflectivity measurements but also magneto-optics and Raman scattering. Raman effect and far infrared spectroscopy data are also included so as to round off the information gained from optics by a discussion of phonons, magnons and intra 5f-transitions.

46774 **Microstructure and deformation in a dynamically compacted copper powder.** Gourdin, W.H. (Lawrence Livermore National Lab., CA). *Materials Science and Engineering;* 67: 179-184(1984). Contract W-7405-ENG-48.

Dynamic (shock wave) compaction of a spherical copper powder having a narrow size distribution yields a distinctive directional microstructure. Powder particles are smooth and convex on the upstream side of the shock propagation direction and sharply peaked on the downstream side. This structure results from differences in material speeds which occur because of release at free surfaces adjacent to voids. The filling of voids thus occurs faster than the deformation of surrounding particles. The structure becomes less apparent as the powder size distribution broadens. An oxide film is observed between powder particles following densification. The possible effects caused by this film are briefly discussed.

46775 **Thermodynamics of formation of intermediate phases in the yttrium-iron and yttrium-cobalt systems.** Subramanian, P.R. Ames, IA; Iowa State Univ. (1984). 76p. University Microfilms Order No. 85-05,873.Contract W-7405-ENG-82.

Thesis (Ph. D.).

Solid electrolyte electromotive force cells have been used to determine the Gibbs free energies, enthalpies, and entropies of formation of binary intermediate-phases in the Y-Fe and Y-Co systems. Solid $CaF_2$ was used as the electrolyte, and EMF measurements were made over the temperature range 850 K to 1271 K with electrochemical cells of the type Y, $YF_3$ absolute value $CaF_2YF_3$, M, YM/sub c/ or Y, $YF_3$ absolute value $CaF_2YF_3$, YM/sub a/, YM/sub b/ where M = Fe or Co, and M and YM/sub c/ or YM/sub a/ and YM/sub b/ are neighboring phases in the Y-M

equilibrium diagram. The data indicate that, at a given stoichiometry, the Gibbs free energy of formation becomes more negative in progression from Y-Fe to Y-Co. The experimental values for the Gibbs free energies of formation of the Y-Fe and Y-Co intermediate phases at 973 K are compared with those of the Th-Fe, Th-Co, Th-Ni, La-Co, and La-Ni systems. Examination of the trend shows that there is an empirical correlation between the Gibbs free energy of formation and the total number of valence electrons in these alloy systems. The experimental enthalpies of formation of the equiatomic alloys in the Y-Fe and Y-Co system are compared with the theoretical predictions of the Midema and Watson-Bennett models. Experimental data for the Y-Fe system favors the Watson-Bennett approximation; in the case of the Y-Co system, however, both predictions are acceptable approximations to the experimental value.

46776 **High-temperature thermodynamics of the zirconium-aluminum system.** Kematick, R.J. Ames, IA; Iowa State Univ. (1984). 137p. University Microfilms Order No. 85-05,833.Contract W-7405-ENG-82.

Thesis (Ph. D.).

Experiments were performed to help elucidate the high temperature phase diagram features and thermodynamic properties of the Zr-Al system. The principal methods used were combinations of high temperature Knudsen effusion, heat treatment and x-ray powder-diffraction experiments performed with Zr-Al samples in the composition range 0 < X/sub Al/ < 0.75. The results of these experiments confirmed in some respects the phase diagram features of Potschke and Schubert (Z. metallkde, 53: 548(1962)). In particular, x-ray powder diffraction experiments performed on samples in the composition range 0.50 < X/sub Al/ < 0.60 quenched from 800-1400°C indicate that ZrAl is stable below 1250°C, $Zr_4Al_3$ below 1000°C, and $Zr_5Al_4$ above about 1100°C. Aluminum vapor pressures were measured over compositions corresponding to mixtures of two solid phases between the compositions $ZrAl_3$ and $Zr_3Al_2$, and as a function of composition over the solid solution of aluminum in bcc zirconium using a combined mass-loss-mass-spectrometric Knudsen effusion technique. In order to successfully measure the low Al pressures (less than $\sim 10^{-8}$ atm) over the more Zr rich samples it was necessary to use a small computer to signal average the mass-spectrometer signal. Data collected over 7 two-phase regions and the solid solutions were used to calculate enthalpies of formation at 298 K of seven Zr-Al compounds. The heat of formation values (kcal/mole) obtained were: $ZrAl_3$ = -38.96, $ZrAl_2$ = -32.86, $Zr_3Al_2$ = -56.12, ZrAl = -21.36, $Zr_5Al_4$ = -93.76, $Zr_2Al_3$ = -48.78, and $Zr_5Al_3$ = -74.57.

46777 **Mechanics and mechanisms of fracture in creeping alloys.** Argon, A.S. (Massachusetts Institute of Technology, Cambridge). pp 1-52 of Recent advances in creep and fracture of engineering materials and structures. Wilshire, B.; Owen, D.R.J. (eds.). Swansea, Wales; Pineridge Press (1982). Contract AC02-77ER04461.

Important advances in the understanding of the mechanics and mechanisms of creep fracture in polycrystalline alloys registered in the past decade are presented. Progress has been made both by the materials scientist in investigating directly in detail the damage mechanisms due to creep, and by the applied mechanician in modeling the micro-structural and macro-structural aspects of this damage. The most impressive nature of this advance is the close coupling that has resulted between the two approaches of materials science and structural design. Examples of this development are presented and areas where more progress is necessary are pointed out.

46778 **Problems in environmentally-affected creep crack growth.** McClintock, F.A.; Bassani, J.L. (Massachusetts Institute of Technology, Cambridge). pp 123-145 of Three-dimensional constitutive relations and ductile fracture. Nemat-Nasser, S. (ed.). Amsterdam, Netherlands; North-Holland Publishing Company (1981). Contract AC02-77ER04461.

Two idealized models are proposed for creep cracking due to environmental effects: a steady, atom-by-atom cracking due to the saturation of the grain boundary by a weakening species, and an intermittent crack advance cleaving between grains of size d/sub g/ when the strength at a distance d/sub g/ from the crack tip falls to the level of the local stress. With either criterion crack meandering does not appear critical, but multiple branching with statistical effects remains unsolved. The fracture criteria are introduced into the asymptotic flow fields for elastic, plastic, and primary, secondary, and tertiary creep fields around stationary cracks and secondary creep fields around growing cracks. Micrographs indicate the limiting scales to which continuum mechanics can be applied. Needed improvements in the flow relations are discussed, especially when nonradial or reversed loading gives important primary creep effects, either due to hardening or to polarity of the dislocation structure. For flexibility in calculating strain fields for such flow relations, a cost effective, explicit time integration scheme, with initial strain finite element solutions is described. Short time steps for stability are alternated with far larger steps to reduce costs.

46779 **Creep crack extension by grain-boundary cavitation.** Bassani, J.L. Philadelphia, PA; University of Pennsylvania ([1985]). 19p. Contract AC02-77ER04461.

Recent work has led to various descriptions of stationary and moving crack tip fields under creep conditions. For stationary and growing cracks, several flow mechanisms (e.g., elastic, time-independent plastic, primary creep, and secondary creep) can dictate the analytical form of the crack tip field. The relationship between overall loading and crack velocities is modelled based upon grain-boundary cavity growth and coalescence within the zone of concentrated strain in the crack tip field. Coupled diffusion and creep growth of the cavities are considered. Overall crack extension is taken to be intermittent on a size scale equivalent to the size of a grain. Numerical results are presented for a center-cracked panel of 304 stainless steel.

## 3602 Ceramics, Cermets, And Refractories

*REFER ALSO TO CITATION(S) 45978, 46161, 46710, 46711, 46711, 46729, 46769, 46819, 46903*

46780 **(CEA-CONF—7409) Specific effect of $H^+$ compared to $Ne^+$ implantation in YIG.** Marest, G.; Gerard, P.; Perez, A. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France)). 1984. 1p. (CONF-840788—3). NTIS (US Sales Only), PC A02/MF A01. File Number DE85752171.

From International conference on the physics of highly ionized atoms; Oxford, UK (2 Jul 1984).

Published in summary form only.

46781 **(CONF-8307138—1) Occurrence and behavior of dislocations during plastic deformation of selected transition metal and silicon carbides.** Davis, R.F.; Carter, C.H. Jr.; Chevacharoenkul, S.; Bentley, J. (North Carolina State Univ., Raleigh (USA); Oak Ridge National Lab., TN (USA)). 1983. Contract AC05-84OR21400. 15p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85016358.

From International symposium on plastic deformation of ceramic materials; University Park, PA, USA (20 Jul 1983).

This paper is a review of the results and a discussion of the possible mechanisms of high temperature deformation and steady state creep in both single and polycrystalline TMMC, including recent results obtained at NCSU on single crystals of NbC/sub x/. This allows a comparison of the derived results and proposed deformation processes using different materials and applied stress parameters.

46782 **(RISO-M—2488) Development of oxygen conductors for oxygen-gas sensors.** Toft Soerensen, O. (Risoe National Lab., Roskilde (Denmark)). Feb 1985. 49p. (In Danish). NTIS (US Sales Only), PC A03/MF A01. File Number DE85752659.

Among the many oxygen conductors known today Gadolinia doped ceria has the greatest ionic conductivity at lower temperature (approximately 500degC). In this project the effort has therefore been concentrated on developing methods for fabrication and characterization of specimens of these oxides. The fabrication methods developed comprises: milling of mixtures of the pure oxides followed by pressing and sintering; coprecipitation of cerium-gadolinium oxalates followed by calcination, milling, press-

ing and sintering; and finally coprecipitation of Ce-Gd-carbonates again followed by calcination, milling, pressing and sintering. To characterize the electrical properties of specimens prepared after these methods, cells were developed to measure emf and electrical conductivity (dc- and ac-method) as a function of oxygen pressure and temperature. From the emf measurements it was concluded that 25 w/o $Gd_2O_3$ is a suitable composition for oxygen sensors and that the minimum temperature for oxygen measurements with ceramic oxygen conductors is about 600degC. Conductivity measurements by the dc-method in the temperature range 450-750degC in air showed that maximum conductivity is obtained for these oxides at 4-6 v/0 $Gd_2O_3$. The conductivity measurements performed by the ac-method in the temperature range 350-950degC in air showed that the conductivity at lower temperature is dominated by the grain boundary conductivity, which is smaller than the lattice conductivity. Generally the conductivity decreases with increasing $Gd_2O_3$ content corresponding to an increase in the migration activation energy. A change in the conduction mechanism was observed at approximately 550degC. Below this temperature the oxygen vacancies created by the doping is considered to be associated with Gd-lattice ions, whereas the vacancies are considered free above this temperature and which explains the observed change in activation energy.

46783 **(SAND—85-1647C) Dynamic compaction of SiC powder.** Akashi, T.; Lotrich, V.; Sawaoka, A.; Beauchamp, E.K. (New Mexico Inst. of Mining and Technology, Socorro (USA). Center for Explosives Technology Research; Sandia National Labs., Albuquerque, NM (USA)). 1985. Contract AC04-76DP00789. 6p. (CONF-850736—60). NTIS, PC A02. File Number DE85016802.

From American Physical Society topical conference on shock waves in condensed matter; Spokane, WA, USA (22 Jul 1985).

Purpose of this work is to study the compaction mechanism of coarse SiC powder in the dynamic compaction process, which may be different from that of the fine powder.

46784 **Large area lanthanum molybdenum electron emitters.** Goebel, D.M.; Hirooka, Y.; Campbell, G.A. (University of California, Los Angeles School of Engineering and Applied Science, Los Angeles, California 90024). *Review of Scientific Instruments;* **56**: No. 10, 1888-1893(Oct 1985). Contract AT03-84ER52104.

A large area, indirectly heated cathode capable of continuous, high- current electron emission is described. The cathode assembly utilizes an indirectly heated lanthanum molybdenum carbide (LaMo) disk as the thermionic electron emitter. Other cathode shapes are also discussed. The disk cathode emits up to 500 A of electrons at an average of 11 $A/cm^2$ in continuous operation in a plasma discharge. LaMo material is machinable and is not fragile even after extended operation. Careful fabrication and conditioning of the LaMo carbide surface is required. The electron emission capability depends strongly on producing the proper fine grain structure of the molybdenum carbide surface layer to allow adequate diffusion of lanthanum to the surface. Failure to produce the correct surface structure results in intermittent electron emission. The electron emission was not affected by exposure to both air and water during operation, but the emission is poisoned by small amounts of tungsten on the surface. After proper preparation, this intermediate temperature electron emitter is very rugged and has a long lifetime.

46785 **Fabrication of low density ceramic material.** Meek, T.T.; Blake, R.D.; Sheinberg, H. (to Dept. of Energy). US Patent Application 6-668,054. 1985. 11p. Contract W-7405-ENG-36. DE85017766 NTIS, PC A02/MF A01; GPO Dep. File Number DE85017766.

A precursor mixture and a method of making a low-density ceramic structural material are disclosed. The precursor mixture includes hollow microballoons, typically made of glass, together with a cementing agent capable of being cured by microwave irradiation. A preferred cementing agent is liquid hydrated potassium silicate, which is mixed with the glass microballoons to form a slurry. Upon irradiation the potassium silicate is dehydrated to form a solid porous matrix in which the microballoons are evenly distributed. Ground glass or other filling agents may be included in the slurry to enhance the properties of the final product. Low-density structural ceramics having densities on the order of 0.1 to 0.3 are obtained.

46786 **Abrasive slurry composition for machining boron carbide.** Duran, E.L. (to Dept. of Energy). US Patent Application 6-676,045. 29 Nov 1984. 7p. Contract W-7405-ENG-36. DE85017722 NTIS, PC A02/MF A01; GPO Dep. File Number DE85017722.

An abrasive slurry particularly suited for use in drilling or machining boron carbide consists essentially of a suspension of boron carbide and/or silicon carbide grit in a carrier solution consisting essentially of a dilute solution of alkylaryl polyether alcohol in octyl alcohol. The alkylaryl polyether alcohol functions as a wetting agent which improves the capacity of the octyl alcohol for carrying the grit in suspension, yet without substantially increasing the viscosity of the carrier solution.

46787 **Studies of ignition and combustion wave propagation in exothermic ceramic systems using high-speed photography.** Melton, G.F.; Behrens, R.G. (Los Alamos National Lab., NM). *Proceedings of the Society of Photo-Optical Instrumentation Engineers;* **497**: 24-28(1984).

From High speed photography, videography, and photonics II; San Diego, CA, USA (21-22 Aug 1984).

High-speed photography is a useful diagnostic tool for studying the propagation of adiabatic combustion waves in highly exothermic solid state chemical systems. Temperatures on the order of 1500 to 4000°C can be achieved within the combustion wave front as it traverses the solid chemical reactants. Wave front propagation rates in such systems are typically 0.5 to 10 cm/sec. High-speed photography (framing speeds of 400-2000 frames/sec) is being used to study the structure of the combustion wave, obtain quantitative combustion wave propagation rates, and to study the details of ignition of the combustion wave using 150 watt HF/DF laser radiation. Examples of photographic experiments as well as examples of the chemical and physical information obtainable from these experiments are presented.

## 3603 Composite Materials

46788 **(BNL—36465) Furfuryl alcohol polymer concretes for use in all-weather repairs of concrete and asphalt surfaces.** Kukacka, L.E.; Sugama, T. (Brookhaven National Lab., Upton, NY (USA)). Apr 1985. Contract AC02-76CH00016. 26p. (CONF-8510115—1). NTIS, PC A03/MF A01; GPO Dep. File Number DE85014825.

From American Concrete Institute fall meeting on polymers in concrete; Chicago, IL, USA (3 Oct 1985).

The following criteria were established: high strength at an age of 1 h, placement of the materials must be possible during heavy precipitation over temperatures ranging from -32° to 52°C, and the chemical constituents should be low cost and have long-term stability when contained in a maximum of three packages during storage. A formulation consisting of furfuryl alcohol monomer (FA), α,α,α- trichlorotoluene, pyridine, silane, zinc chloride, silica filler, and coarse aggregate meets these requirements. Optimized formulations were established for use with premixed and percolation placement methods. The premixed formulation is compatible with moisture contents up to 4% by weight of the total mass, which simulates placement in a 2.54 cm/h rainfall. The working time for the FA-PC slurry can be controlled at ≧ 15 min over the entire operating temperature range by simply varying the α,α,α-trichlorotoluene catalyst concentration while holding all of the other constituents constant. Prototype equipment for the mixing and placement of FA-PC was demonstrated: a concrete transit mix supply of mixed aggregate, a hopper-fed volumetric feed screw which supplied aggregate at a known rate to a mixing screw, and a monomer pump and spray nozzle. The unit mixed and delivered FA-PC at ~182 kg/min. The practicability of using equipment currently employed for the continuous placement of conventional portland cement concrete was proven. Field tests were performed under rainfall and dry conditions at temperatures ranging from -15° to 35°C. The mixing and placement equipment performed well and

the FA-PC slurries exhibited self-leveling characteristics. Test results from proxy samples prepared during the placement of the patches and cores taken after simulated aircraft trafficking, indicated that the property requirements at an age of 1 hr were attained.

**46789 (UCRL—76257) Acoustic emission uses in research and development of composite materials.** Hamstad, M.A. (Lawrence Livermore National Lab., CA (USA)). 21 Nov 1974. 31p. NTIS.

A comprehensive guide to the use of acoustic emission testing in the research and development of composite materials is presented. Included are discussions of: (1) the unique information to be gained from acoustic emission data, (2) the sources of acoustic emission in composites, (3) successful composite acoustic emission testing, (4) the measurement and the interpretation of acoustic emission from composites, (5) the specific applications of previous acoustic emission data from composites, and (6) the future directions of acoustic emission research in the field of composites.

## 3604 Polymers And Plastics

*REFER ALSO TO CITATION(S) 46983, 47135*

**46790 (CEA-CONF—7614) ESR and NMR spectra simulation applied to molecular dynamics in anisotropic medium.** Chachaty, C. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Sep 1984. 14p. (In French). (CONF-8409240—2). NTIS (US Sales Only), PC A02/MF A01. File Number DE85752172.

From French Society of Chemistry congress; Nancy, France (17 Sep 1984).

We describe two conversational programs written in APL for the purpose of ESR and NMR spectra simulations as well as relaxation times and line width calculations. These programs are particularly convenient for the studies of the molecular order and dynamics in liquid crystals. Several examples of their applications are reported.

**46791 (CEA-CONF—7615) Set of programs for the conformational study by NMR of flexible molecules.** Chachaty, C.; Langlet, G. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Sep 1984. 14p. (In French). (CONF-8409240—3). NTIS (US Sales Only), PC A02/MF A01. File Number DE85752173.

From French Society of Chemistry congress; Nancy, France (17 Sep 1984).

A series of programs of common modular structure have been written in APL for the interpretation of nuclear magnetic resonance and relaxation data in isotropic or anisotropic solutions (liquid crystals). After giving an outline of the computation methods, several examples are reported of the applications of these programs to conformational studies by means of the nuclear relaxation and of the diamagnetic of paramagnetic shifts of resonance lines. These programs are also convenient for studies of dipolar and quadrupolar splittings or chemical shift anisotropy in liquid crystals.

**46792 (DOE/ER/45114—1) Statistical mechanics of polymer systems. Annual report.** Kovac, J. (Tennessee Univ., Knoxville (USA). Dept. of Chemistry). 1 May 1985. Contract FG05-84ER45114. 8p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85017986.

In the original proposal three areas of research were outlined: development of models for isolated polymer chain dynamics using projection operator techniques; study of the effect of entanglements on the dynamics polymer chains by means of computer simulation; and nonequilibrium thermodynamic and statistical mechanical theories of the glass transition. During the past eight months almost all of our efforts have been focused on computer simulation. The original single chain simulation algorithm has been extended to multiple chain systems in order to study the effects of interchain entanglements on the chain dynamics. In addition, we have performed a normal coordinate analysis of the dynamics of single chains in order to further elucidate the effect of excluded volume on the chain motion. The current status of our computer simulation research is described. A brief description of plans for research in theories of the glass transition is also given.

**46793 (LA-UR—85-2212) Effect of polymer morphology on proton and water transport through ionomeric polymers.** Fales, J.L.; Springer, T.E.; Vanderborgh, N.E.; Stroeve, P. (Los Alamos National Lab., NM (USA); California Univ., Davis (USA). Dept. of Chemical Engineering). 1985. Contract W-7405-ENG-36. 17p. (CONF-850542—5). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85014086.

From 167. Electrochemical Society meeting; Toronto, Ontario, Canada (12 May 1985).

The rate of ionic transport through perfluorosulfonic acid membranes is set by water content within mass transfer channels of the polymer. Consequently, control of water flux is important to control transport rates. Experiments show the influence of cation type on water transport properties and on polymer physical properties. These results support the model that channel geometries are determined by the interaction of coulombic forces within the membrane. Description of these transport processes is accomplished through several mathematical routes.

**46794 (UCID—20502) Evaluation of tearing energies in styrene-butadiene rubbers.** Goldberg, A.; Lesuer, D.R.; Stone, J.C.; Patt, J. (Lawrence Livermore National Lab., CA (USA); Army Tank-Automotive Command, Warren, MI (USA)). 25 Jun 1985. Contract W-7405-ENG-48. 63p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85013240.

Tearing energies were obtained on samples removed from commercial tank-track pads and on a series of SBR laboratory formulations in which the carbon-black content varied from 0 to 40 wt %. The commercial materials were tested at a strain rate of $10^{-1}$/s with temperatures ranging from 22 to 140°C. The laboratory materials were tested also at both lower and higher strain rates and at -20°C. We evaluated the effect of temperature, strain rate, and carbon-black content on tearing energy, failure stress, and failure strain. The results, including the shape of the stress-strain curves, are discussed in terms of viscoelasticity, uncoiling of the long molecular chains, carbon-black rubber interactions, and knotty tearing. In the absence of knotty tearing and for carbon-black contents of 20 wt % or less the tearing energy, the failure stress, and failure elongation increased with either a decrease in temperature or an increase in carbon-black content. With the first appearance of knotty tearing, which occurred at 20 to 25 wt % carbon black, large increases in tearing energy and failure strength were obtained. Between 25 and 40 wt % carbon black both tearing energy and failure stress varied irregularly with either the carbon-black content or temperature. The trends obtained with the commercial materials are consistent with those exhibited by the laboratory formulations in the 25 to 40% carbon-black range. Results for the 35-wt % formulation fell within the range of results obtained for the commercial materials.

**46795 Conducting polymer solutions: An EPR and INDO/CI study of a radical cation observed in conducting poly( p-phenylene sulfide) solutions.** Murray, D.P.; Kispert, L.D.; Frommer, J.E. (Department of Chemistry, University of Alabama, Tuscaloosa, Alabama 35486). *Journal of Chemical Physics;* **83**: No. 7, 3681-3684(1 Oct 1985).

We report here the observation of resolved EPR hyperfine couplings for the conducting polymer $AsF_5$-doped poly( p-phenylene sulfide), dissolved in liquid $AsF_3$. Correlation of the EPR and INDO results indicates that the observed signal is due to a nonplanar sulfur-centered radical cation with the hyperfine pattern arising from the coupling of the electron to the four meta $^1H$'s on the adjacent phenyl rings.

**46796 Method of forming a foamed thermoplastic polymer.** Duchane, D.V.; Cash, D.L. (to Dept. of Energy). US Patent Application 6-673,968. 21 Nov 1984. 11p. Contract W-7405-ENG-36. DE85017772 NTIS, PC A02/MF A01; GPO Dep. File Number DE85017772.

A solid thermoplastic polymer is immersed in an immersant solution comprising a compatible carrier solvent and an infusant solution containing an incompatible liquid blowing agent for a time sufficient for the immersant solution to infuse into the polymer. The carrier solvent is then selectively extracted, preferably by a solvent

exchange process in which the immersant solution is gradually diluted with and replaced by the infusant solution, so as to selectively leave behind the infustant solution permanently entrapped in the polymer. The polymer is then heated to volatilize the blowing agent and expand the polymer into a foamed state.

46797 **Polyacetylene fibril growth in soluble Ziegler-Natta catalysts.** Aldissi, M.; Schue, F. (Los Alamos National Lab., NM). *Macromolecules;* 17: 1633-1634(1984).

Free-standing polyacetylene films prepared by using the soluble Ziegler-Natta catalyst $Ti(OBu)_4/AlEt_3$ are of great interest for they exhibit an electrical conductivity in the metallic regime, $10^3$ (Omega cm)$^{-1}$, when doped with various donors or acceptors. Scanning electron microscopy shows that the as-formed films consist of randomly oriented fibrils with a diameter and an interfibrillar distance depending upon the polymerization conditions. A detailed mechanistic study of the polymerization at -78°C showed that the number of active centers for polymerization of acetylene, which consists of Ti/sup III/ species, is only one part per thousand of the total amount of catalyst. The morphology of the films and the fibril dimensions have a great effect on the properties of the polymer when it is doped with electron donors or acceptors, chemically or electrochemically. The doping process consists of the diffusion of the doping ion into the film and its fibrils with known diffusion rates under well-defined conditions. The homogeneity of the material is consequently affected by the diffusion factor, and therefore it is important to study the nature of the host polymer.

## 3606 Other Materials

*REFER ALSO TO CITATION(S) 46016, 46171, 46313, 46325, 46326, 46328, 46328, 46329, 46330, 46331, 46338, 46340, 46341, 46350, 46457, 46458, 46596, 46660, 46698, 46722, 46765, 46766, 46773, 46962, 47165, 47165, 47207, 47209*

46798 **(BNL—36704) First order phase transformations: scaling relations for grain self-correlation functions.** Axe, J.D.; Shapiro, S.M.; Yamada, Y.; Hamaya, N. (Brookhaven National Lab., Upton, NY (USA); Osaka Univ., Toyonaka (Japan). Faculty of Engineering Science). Jun 1985. Contract AC02-76CH00016. 7p. (CONF-8504153—2). NTIS, PC A02/MF A01; GPO Dep. File Number DE85017509.

From NATO advanced studies conference on scaling phenomena in disordered systems; Geilo, Norway (10 Apr 1985).

At high pressure many alkali halides transform from the NaCl (B1) structure to the CsCl (B2) structure. We have recently studied this transformation in polycrystalline RbI, which transforms at a critical pressure, P/sub c/ = 3.5 kbar. By observing the time development of the neutron diffraction pattern after sudden increase of hydrostatic pressure from P<P/sub c/ to P>P/sub c/ we directly deduced X(t), the fraction of the sample converted from metastable to stable phase, as a function of time. We showed that X(t) taken at different P could be approximately scaled onto a universal growth curve by introducing an adjustable characteristic time tau(P) for each curve. The success of the Kolmogorov in fitting X(t) suggests that comparisons of model predictions with other experimental observables be made on the system. For example, by a trivial (in principle) extension of the neutron diffraction techniques described above, one might determine the broadening of the powder diffraction peaks due to finite grain size as a function of time throughout growth. This particle size broadening is related by Fourier transformation to the grain autocorrelation function, G/sub s/(r,t), which measures the ensemble average of the overlap of grains with themselves upon translation of the grain pattern by an amount r. We present some results of a study of the scaling properties of G/sub s/(r,t) for the Kolmogorov model for d=1 and d=2. Although the model is highly idealized, it is perhaps the simplest conceivable one which obeys correlation function scaling in early stages of growth and undergoes nontrivial saturation due to volume fraction effects in the late stages. 4 refs., 6 figs.

46799 **(CONF-850840—16) Comparison of ion milling techniques for cross-sectional TEM of semiconductors.** Luck, J.T.; Boggs, C.W.; Pennycook, S.J. (Oak Ridge National Lab., TN (USA)). Mar 1985. Contract AC05-84OR21400. 3p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016596.

From Joint meeting of the Electron Microscopy Society of America and the Microbeam Analysis Society; Louisville, KY, USA (5 Aug 1985).

The use of cross-sectional Transmission Electron Microscopy (TEM) has become invaluable for the characterization of the near-surface regions of semiconductors following ion-implantation and/or transient thermal processing. A fast and reliable technique is required with produces a large thin region while preserving the original sample surface. New analytical techniques, particularly the direct imaging of dopant distributions, also require good thickness uniformity. Two methods of ion milling are commonly used, and are compared. The older method involves milling with a single gun from each side in turn, whereas a newer method uses two guns to mill from both sides simultaneously.

46800 **(EFI—617(7)-83) Investigation of radiation defects in solids using the EXAFS method.** Eritsyan, G.N. (Erevanskij Fizicheskij Inst. (USSR)). 1983. 9p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85702054.

The EXAFS method is proposed as a more informative, universal one to investigate the radiation defects in solids. The successful results as obtained by the author using the synchrotron radiation source are reported for the first time. The measurements were carried out in GaAsP crystals irradiated with 50 MeV electrons.

46801 **(FRNC-TH—2007) Study by photoluminescence of centers associated to oxygen and carbon in silicon.** Lazrak, A. (Grenoble-1 Univ., 38 - La Tronche (France); CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France)). Dec 1984. 105p. (In French). NTIS (US Sales Only), PC A06/MF A01. File Number DE85752180.

Results on analysis of luminescence of impurities in silicon are examined. Then in chapter 5, p. 76 to 91, irradiation of silicon by electrons is studied, interaction of defects created and diffusion, influence of carbon, oxygen and doping materials, annealing at 450°C, photoluminescence spectra are investigated.

46802 (INIS-mf—9652, pp 32) **Molecular beam epitaxy of silicon.** Kasper, E. (AEG-TELEFUNKEN Forschungsinstitut, Ulm (Germany, F.R.)). 1984. (In German). NTIS (US Sales Only), PC A07/MF A01. File Number DE85781476. (CONF-8409235—Summ.).

From Annual meeting of the Austrian Physical Society; Leoben, Austria (24 Sep 1984).

Published in summary form only.

46803 (INIS-mf—9714, pp 11-12) **Investigation of atomic structure and chemical composition of electrolytic layers.** Rendulic, K.D.; Leisch, M.; Reinmueller, H. (Technische Univ., Graz (Austria). Inst. fuer Festkoerperphysik). Nov 1984. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number DE85781213.

Published in summary form only.

In Progress report 1983/1984 of the Solid State Institute of the Technical University of Graz.

46804 (INIS-mf—9742, pp 181-185) **Possibilities of studying silicon carbide semiconductor using track autoradiography method.** Goncharov, E.E.; Ryabova, G.G.; Mokhov, E.N. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow). 1983. (In Russian). NTIS (US Sales Only), PC A12/MF A01. File Number DE85781598. (CONF-8305206—).

From 13. international symposium on autoradiography; Tabor, Czechoslovakia (2 May 1983).

The SiC semiconductor with an addition of boron and lithium was irradiated with thermal neutrons. The detection of alpha particles from the reactions $^{10}B(n, alpha)^7Li$ and $^6Li(n, alpha)^3H$ was made using an cellulose acetobutyrate track detector. The parameters of track density on the detector and of the thermal neutron fluence were determined by calculation and experimentally. The relation was thus obtained for the determination of boron and lithium concentration in SiC. The equation is given for the calculation of the track density of the individual elements. The limits of detection determined for boron in SiC was $9 \times 10^{18}$ at/cm$^3$ and for

lithium 1 x $10^{17}$ at/$cm^3$. Autoradiographic monitoring was carried out of boron concentration distribution, boron diffusion and lithium diffusion in monocrystals and lithium solubility in SiC. (E.S.).

46805 (INIS-mf—9742, pp 190-197) **Autoradiographic investigations in the field of technical carbon production by the aid of the Densitron II.** Wagner, K.; Graetsch, T. (Akademie der Wissenschaften der DDR, Berlin. Inst. fuer Chemische Technologie); Indorf, H. (VEB Elektrokohle Lichtenberg, Berlin-Lichtenberg (German Democratic Republic)). 1983. NTIS (US Sales Only), PC A12/MF A01. File Number DE85781598. (CONF-8305206—).

From 13. international symposium on autoradiography; Tabor, Czechoslovakia (2 May 1983).

We have been using the qualitative evaluation of autoradiographs of labelled samples of technical carbon for many years in studying mixing processes, the distribution of elements or components in the bulk or in surface layers, etc. For quantitative evaluation of the concentration of labelled components of the samples counting techniques have been applied but they give no information about the distribution within the sample. We use the following way of solving the problem with the aid of quantitative autoradiography: blackening is divided into at least three ranges by means of Densitron II and the parts of each of the ranges are found out. The values give useful characterization of the inhomogenity of the mixture. Furthermore, the "pseudo-colour representation" by Densitron II enables us to show interesting parts of the autoradiographs like the maximum, the minimum, or other characteristical blackening ranges better than using the black and white representation. (author).

46806 (INIS-mf—9743, pp 52-56) **Basic radiation sterilization properties of packaging materials.** Zouharova, A.; Kolarova, J.; Olbrichova, D. (Statni Vyzkumny Ustav Textilni, Veverska Bityska (Czechoslovakia)). 1984. (In Czech). NTIS (US Sales Only), PC A04/MF A01. File Number DE85781606. (CONF-8411173—).

From Seminar on application of ionizing radiation in foods and feeds treatment; Prague, Czechoslovakia (28 Nov 1984).

The foils of various materials were irradiated with $^{60}Co$ with an activity of 11,538 TBq. The minimum radiation dose was 25 kGy. Changes in chemico-physical properties were evaluated by infrared spectroscopy and were not detected after irradiation with 25 kGy. Packing foils were subjected to the following tests: mechanical tests, tests of weld strength, tests of impact resistance, free fall tests, permeability tests for water vapour and microbiological tests. The results of all tests were tabulated. The tests showed that the foils are impermeable for microorganisms and provided the welds are airtight the packed products remain sterile. (J.P.).

46807 (INIS-mf—9766) **Symposium on ion implantation. Programme and abstract booklet.** (South African Inst. of Physics, Faure; Pretoria Univ. (South Africa). Dept. of Physics; Pretoria Univ. (South Africa). Carl and Emily Fuchs Inst. for Microelectronics). 1983. 20p. (CONF-8307157—Absts.). NTIS (US Sales Only), PC A02/MF A01. File Number DE86780005.

From Symposium on ion implantation; Pretoria, South Africa (11 Jul 1983).

Separate abstracts were prepared for papers from the symposium on ion implantation held in Prectoria, South Africa, 11 July, 1983.

46808 (JAERI-M—84-091) **Irradiation induced defects containing oxygen atoms in germanium crystal as studied by deep level transient spectroscopy.** Fukuoka, Noboru; Kambe, Yoshiyuki; Saito, Haruo; Matsuda, Koji. (Japan Atomic Energy Research Inst., Tokyo). May 1984. 19p. (In Japanese). NTIS (US Sales Only), PC A02/MF A01. File Number DE85702056.

Deep level transient spectroscopy was applied to the electron trapping levels which are associated with the irradiation induced lattice defects in germanium crystals. The germanium crystals used in the study were doped with oxygen, antimony or arsenic and the defects were formed by electron irradiation of 1.5MeV or 10MeV. The nature of so called "thermal defect" formed by heat treatment at about 670K was also studied. The trapping levels at Esub(c)-0.13eV, Esub(c)-0.25eV and Esub(c)-0.29eV were found to be associated with defects containing oxygen atoms. From the experimental results the Esub(c)-0.25eV level was attributed to the germanium A-center (interstitial oxygen atom-vacancy pair). Another defect associated with the 715$cm^{-1}$ infrared absorption band was found to have a trapping level at the same position at Esub(c)-0.25eV. The Esub(c)-0.23eV and Esub(c)-0.1eV levels were revealed to be associated with thermal donors formed by heat treatment at about 670K. Additional two peaks (levels) were observed in the DLTS spectrum. The annealing behavior of the levels suggests that the thermal donors originate from not a single type but several types of defects.

46809 **Growth of the 889 $cm^{-1}$ infrared band in annealed electron-irradiated silicon.** Svensson, B.G.; Lindstroem, J.L.; Corbett, J.W. (Foersvarets Forskningsanstalt, Box 1165, S-581 11 Linkoeping, Sweden). *Applied Physics Letters;* **47**: No. 8, 841-843(15 Oct 1985).

Isothermal annealing of electron-irradiated Czochralski silicon has been studied at four different temperatures ranging from 304 to 350 °C using infrared spectroscopy. At annealing temperatures above 300 °C the irradiation-induced band at 830 $cm^{-1}$, usually attributed to a vacancy-oxygen complex (the A center), disappears and a new band at 889 $cm^{-1}$ grows up. Within the experimental accuracy , the activation energy for the growth of this band is found to be identical with the value given by Stavola et al. for "anomalous" oxygen diffusion in silicon. Also the frequency factors for the two processes are in reasonable agreement. Our results show that a vacancy-assisted process may provide an explanation for enhanced motion of oxygen in silicon.

46810 **Strengthened solid-state laser materials.** Marion, J. (Lawrence Livermore National Laboratory, University of California, P.O. Box 5508, L-490, Livermore, California 94550). *Applied Physics Letters;* **47**: No. 7, 694-696(1 Oct 1985). Contract W-7405-ENG-48.

The tensile fracture strength of crystalline materials for high average power lasers has been increased by a factor of 15 using deep chemical polishing. Samples of gadolinium scandium gallium garnet, gadolinium gallium garnet, and yttrium aluminum garnet, which were prepared by conventional mechanical techniques to a high quality polish, were found to contain subsurface damage up to 50 μm in depth. When this damage was removed by deep chemical etching, the mean strength of small, four-point flexure specimens increased from 155 to 2280 MPa; however, these samples were no longer optically flat after etching. Specimens in which the optical figure was restored by polishing after the etch had an intermediate strength of 630 MPa.

46811 **Dangling bonds and the Urbach tail in silicon.** Seager, C.H.; Lenahan, P.M.; Brower, K.L.; Mikawa, R.E. (Sandia National Laboratories, Albuquerque, New Mexico 87185). *Journal of Applied Physics;* **58**: No. 7, 2704-2708(1 Oct 1985). Contract AC04-76DP00789.

Electron spin resonance (ESR) and highly sensitive optical-absorption measurements have been performed on plastically deformed silicon, polycrystalline silicon, and high interface state density, oxidized silicon samples. In the first two cases, the response of the Urbach-like subgap optical absorption and the "dangling bond" ESR signal following thermal and atomic hydrogen anneals is found to be distinctly different from that reported previously for polycrystalline silicon. These data suggest that transitions of the dangling bond are not responsible for this Urbach-like behavior. In addition, we find that removal of the interfacial silicon dangling bond by oxide stripping results in no measurable sample absorptance decreases, implying a considerably lower optical cross section than has been previously estimated for dangling bonds in the bulk.

46812 **Optical absorption and dangling bonds in damaged silicon.** Seager, C.H.; Lenahan, P.M. (Sandia National Laboratories, Albuquerque, New Mexico 87185). *Journal of Applied Physics;* **58**: No. 7, 2709-2712(1 Oct 1985). Contract AC04-76DP00789.

We have examined the optical absorption and spin-resonance signal characteristics of thin layers of silicon damaged by an abrasive process at room temperature. We find an Urbach-like dependence of the subgap absorption and a g = 2.0055 isotropic spin-resonance signal characteristic of silicon dangling bonds. Changes in the optical and spin-resonance data caused by thermal anneals in air, or in atomic hydrogen, indicate that direct electronic transitions of the dangling bond defect are not responsible for the observed optical-absorption spectra. The doping level dependence of these spectra is consistent with the hypothesis that electronic transitions arising from disorder-induced band-tail states cause the subgap absorption.

46813 **Extraction of phonon density of states from optical spectra.** Hjalmarson, H.P.; Romero, L.A.; Ghiglia, D.C.; Jones, E.D.; Norris, C.B. (Sandia National Laboratories, Albuquerque, New Mexico 87185). *Physical Review [Section] B: Condensed Matter;* **32**: No. 6, 4300-4303(15 Sep 1985).

A new method for inversion of optical luminescence spectra to obtain electron-phonon spectral densities is described. The method has been devised to invert error- and noise-contaminated experimental spectra. Although direct inversion is an ill-posed problem, our method succeeds by exponential attenuation of the spectral region distant from the zero-phonon line, especially the spectral tails. The method is illustrated by application to model data, and it is successfully applied to pulsed-laser data for ZnTe:O taken at 10 K. The resultant phonon density of states reveals dominant coupling to TA- and LO-phonon modes.

46814 **Deposition of cesium iodide on Parylene-N pellicles.** Tassano, P.L. (University of California, Lawrence Livermore National Laboratory, Livermore, California 94550). *Journal of Vacuum Science and Technology, A: Vacuum, Surfaces, and Films;* **3**: No. 5, 2036-2037(Sep 1985). Contract W-7405-ENG-48.

During the development of a photocathode for a streak camera, Cesium Iodide was vacuum coated onto Parylene-N pellicles. This paper outlines the handling and vacuum evaporation coating techniques which were used to deposit CsI upon Parylene-N and presents a comparison of results between Lawrence Livermore National Laboratory produced foils and those which were commercially available. (AIP)

46815 **Photothermal-lensing measurements of two-photon absorption and two-photon-induced color centers in borosilicate glasses at 532 nm.** White W.T. III; Henesian, M.A.; Weber, M.J. (Lawrence Livermore Laboratory, University of California, Livermore, California 94550). *Journal of the Optical Society of America B: Optical Physics;* **2**: No. 9, 1402-1408(Sep 1985). Contract W-7405-ENG-48.

Using photothermal lensing, we have measured two-photon absorption coefficients and have observed laser-induced solarization at 532 nm in the transparent borosilicate glasses BK-3, BK-7, and BK-10. The two-photon absorption coefficients at 532 nm are 0.6, 2.9, and 0.4 cm/TW for BK-3, BK-7, and BK-10, respectively. This is approximately 2 orders of magnitude smaller than the two-photon absorption coefficients of crystalline materials of comparable energy-band gap. Our results in BK-7 indicate that a two-photon process initiates the solarization and that one-photon bleaching limits it. The maximum induced absorption at 532 nm in BK-7 is approximately 0.07 $cm^{-1}$ per $GW/cm^2$.

46816 **Spatial and temporal structure of chaotic instabilities in an electron-hole plasma in Ge.** Held, G.A.; Jeffries, C. (Department of Physics, University of California, Berkeley, California 94720 and Materials and Molecular Research Division, Lawrence Berkeley Laboratory, Berkeley, California 94720). *Physical Review Letters;* **55**: No. 8, 887-890(19 Aug 1985). Contract AC03-76SF00098.

Helical instabilities in an electron-hole plasma in Ge in parallel dc electric and magnetic fields are known to exhibit chaotic behavior. By fabricating probe contacts along the length of a Ge crystal we study the spatial structure of these instabilities, finding two types: (i) spatially coherent and temporally chaotic helical density waves characterized by strange attractors of fractal dimension $d \sim 3$, and (ii) beyond the onset of spatial incoherence, instabilities of indeterminately large fractal dimension $d > 8$. A transition between these two types of behavior is observed as the applied fields are increased.

46817 **Multiple analysis of an unknown optical multilayer coating.** Dobrowolski, J.A.; Ho, F.C.; Waldorf, A.; Mitchell, D.F.; Costich, V.R.; Vincent, S.; Thoeni, W.; Casparis, E.; Pfefferkorn, R.; Bartella, J. (Division of Physics, National Research Council of Canada, Ottawa, Ontario K1A 0R6). *Applied Optics;* **24**: No. 16, 2625-2646(15 Aug 1985).

Results are given of the analysis at five different laboratories of an unknown optical multilayer coating. In all, eleven different analytical and laboratory techniques were applied to the problem. The multilayer nominally consisted of three dielectric and two metallic layers. It was demonstrated convincingly that with present day techniques it is possible to determine the basic structure of such a coating.

46818 **Soliton experiments in stimulated raman scattering.** Wenzel, R.G.; Carlsten, J.L.; Druehl, K.J. (U. S. Department of Energy). *Journal of Statistical Physics;* **39**: No. 3, 621-674(Jun 1985).

Experimental observations of solitons in stimulated Raman scattering are reported. Soliton formation resulted from the introduction of a $\pi$ phase shift in the incident Stokes beam as predicted by theory. Pulse sharpening and retardation on propagation in the Raman medium have been observed along with amplitude diminution. The first two features were predicted and the third was not. Spontaneous soliton formation has been observed in the absence of any amplitude modulation or apparent phase shift in the optical fields, indicating that additional sets of initial conditions may result in soliton formation.

46819 **Neutron powder diffraction study of zirconium bromide deuteride, ZrBrD. Two hydrogen atoms in the same metal interstice.** Wijeyesekera, S.D.; Corbett, J.D. (Ames Lab., IA (USA); Iowa State Univ., of Science and Technology, Ames (USA). Dept. of Chemistry). *Solid State Communications;* **54**: No. 7, 657-660(May 1985).

The D atoms in the double-metal-layered compound ZrBrD have been located and refined by Rietveld analysis of the powder neutron diffraction (IPNS). Interestingly, the D atoms are approximately trigonal planar to Zr, a pair lying 0.25 A inside opposite triangular faces in the trigonal antiprismatic ("octahedral") zirconium interstices (d(D-D)=2.204 (8) A). Similar trends for single D atoms can be recognized in the structures of the rare earth metal trihydrides. The refinement also shows a small occupation of tetrahedral interstices which are less favourable owing to short H...Br distances. These second nearest neighbour interactions are generally important in hydride structures.

46820 **Process for the epitaxial deposition of III-V compounds utilizing a binary alloy as the metallic source.** Quinlan, K.P.; Erstfeld, Th.E. (to Secretary of the Air Force). US Patent 4,504,329. 12 Mar 1985. Filed date 6 Oct 1963. vp.

PAT-APPL-539603.

The present invention provides for the deposition of group III-V ternary epitaxial films onto the surfaces of suitable semiconductor substrates. The deposition is accomplished by a vapor phase epitaxy-hydride technique using a group III binary alloy as a group III metal source and phosphine, arsine or stibine as a group V hydride source.

46821 **Inorganic-polymer-derived dielectric films.** Brinker, C.J.; Keefer, K.D.; Lenahan, P.M. (to Dept. of Energy). US Patent Application 6-704,697. 25 Feb 1985. 45p. Contract AC04-76DP00789. DE85017763 NTIS, PC A03/MF A01; GPO Dep. File Number DE85017763.

A method is disclosed for coating a substrate with a thin film of a predetermined porosity. The method comprises: depositing the thin film on the substrate from a non-gelled solution comprising at least one metal alkoxide of a polymeric network forming cation, water, an alcohol compatible with the hydrolysis and the polymerization of the metal alkoxide, and an acid or a base; prior to said depositing step, controlling the porosity and structure of said coat-

ing for a given composition of said solution exclusive of the acid or base component and the water component, by adjusting each of the water content, the pH, the temperature and the time of standing of said solution, increasing/descreasing the water content or the pH to increase/decrease the pore size of said coating, and increasing/decreasing the temperature or time of standing of said solution to increase/decrease the pore size of said coating; and curing said deposited film at a temperature effective for curing whereby there is obtained a thin film coating of a predetermined porosity on the substrate.

**46822 Method of synthesizing and growing copper-indium-diselenide ($CuInSe_2$) crystals.** Ciszek, T.F. (to Dept. of Energy). US Patent Application 6-676,343. 29 Nov 1984. 20p. Contract AC02-83CH10093. DE85017729 NTIS, PC A02/MF A01; GPO Dep. File Number DE85017729.

A process for preparing $CuInSe_2$ crystals includes melting a sufficient quantity of $B_2O_3$ along with stochiometric quantities of Cu, In, and Se in a crucible in a high-pressure atmosphere of inert gas to encapsulate the $CuInSe_2$ melt and confine the Se to the crucible. Additional Se in the range of 1.8 to 2.2% over the stochiometric quantity is preferred to make up for small amounts of Se lost in the process. The melt can then be cooled slowly to form the crystal as direct solidification, or the crystal can be grown by inserting a seed crystal through the $B_2O_3$ encapsulate into contact with the $CuInSe_2$ melt and withdrawing the seed upwardly to grow the crystal thereon from the melt.

**46823 Oxidation of singular and vicinal surfaces of silicon: the structure of $Si-SiO_2$ interface.** Mazur, J.H.; Gronsky, R.; Washburn, J. (Lawrence Berkeley Lab., CA). *Proceedings of the Society of Photo-Optical Instrumentation Engineers;* **463**: 88-92(1984). Contract AC03-76SF00098.

From Advanced semiconductor processing and characterization of electronic and optical materials; Los Angeles, CA, USA (24-25 Jan 1984).

The structure of interfaces between silicon oxides grown in dry oxygen on singular and vicinal (111) surfaces of silicon has been studied using cross-sectional high resolution transmission electron microscopy. Crystalline silicone was found to terminate abruptly on (111) planes, where it transforms to amorphous $SiO_2$. One interplanar distance high ledges, separated by (111) terraces were found to be present on all surfaces studied. The width of the terraces was surface orientation dependent. It is suggested that such a structure of the interface can be explained by a terrace-ledge-kink model and that high temperature oxidation proceeds by a ledge mechanism similar to that for evaporation from the surface.

**46824 Photoemission studies of carbon overlayers on Nb.** Krummacher, S.; Wesner, D.; Carr, R.; Strongin, M.; Sham, T.K.; Eberhardt, W. (State Univ. of New York, Stony Brook). *Proceedings of the Society of Photo-Optical Instrumentation Engineers;* **447**: 42-46(1984). Contract AC02-80ER10750;AC02-76CH00016.

The electronic properties of the amorphous, graphitic, and carbidic phases of carbon layers on niobium were studied. While features of the valence band photoemission and absorption cross section spectra have been discussed in separate publications, this presentation focuses on the observation of resonant photoemission and the photon-induced Auger spectra.

**46825 Effect of pulse duration on the annealing of ion implanted silicon with a XeCl excimer laser and solar cells.** Young, R.T.; ven der Leeden, G.A.; Christie, W.H.; Narayan, J.; Rothe, D.E.; Sandstrom, R.L. (Oak Ridge National Laboratory). pp 401-406 of Laser solid interactions and transient thermal processing of materials. Vol. 13. Narayan, J.; Brown, W.L.; Lemons, H.A. Amsterdam, Holland; Elsevier Science Publishing (1983). (CONF-8211153—).

From MRS symposium on laser-solid interactions and transient thermal processing of materials; Boston, MA, USA (1 Nov 1982).

The advantages of pulsed excimer lasers for semiconductor processing are reviewed. Studies of XeCl excimer laser annealing with pulses of 25 and 70 nsec duration and energy densities in the range from 0.5-3.0 J/cm$^2$ are discussed. The annealing characteristics are described in terms of the results of melt depth, dopant profile spreading, and electrical properties (sheet resistivity, diode characteristics) measurements. Solar cells with efficiencies as high as 16.7% AM1 have been fabricated using glow discharge implantation and XeCl laser annealing.

# 40 CHEMISTRY

**46826 (LUTKDH/TKKA—7003/1-15) Recent, current and planned research activities.** Aly, G.; Jernqvist, Aa.; Wimmerstedt, R. (SEE CODE- 9860206 Lund Inst. of Technology (Sweden). Dept. of Chemical Engineering). 1983. 67p. NTIS (US Sales Only), PC A04/MF A01. File Number DE85752513.

The report gives a survey of the activities of more than 10 years. The research activity has been within solid-liquid separation, process simulation of unit operations solvent extraction, energy engineering and absorption. New research fields have been entered namely two phase flow, phase equilibria and supercritical gas extraction and finally biotechnology. An extensive list of publications is included. Financing and future planning is presented.

## 4001 Analytical And Separations Chemistry

*REFER ALSO TO CITATION(S) 46149, 46150, 46164, 46875, 46910, 46957, 46969, 47078, 47191*

**46827 (CONF-850574—1) Comments on "optimization".** Bayne, C.K. (Oak Ridge National Lab., TN (USA)). 1985. Contract AC05-84OR21400. 8p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85017085.

From Chemometrics research conference; Gaithersburg, MD, USA (20 May 1985).

Comments are made on Dr. S.N. Deming's paper on optimization in analytical chemistry: optimization applications, strategies for screening experiments, and steepest ascent method. (DLC)

**46828 (CONF-850840—15) Mechanical prethinning and thinning of unique materials for TEM.** Haltom, C.P. (Oak Ridge National Lab., TN (USA)). 1985. Contract AC05-84OR21400. 3p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016598.

From Joint meeting of the Electron Microscopy Society of America and the Microbeam Analysis Society; Louisville, KY, USA (5 Aug 1985).

A mechanical dimpling device and ion milling have been used to prepare TEM specimens of $Al_2O_3$ spheres overcoated with pyrocarbon and SiC. Tensile specimens of partially stabilized zirconia were also prepared for feacturing in an electron microscopy. (DLC)

**46829 (CONF-8111229—, pp vp) Spectroscopic studies on surface reactions between minerals and reagents in flotation systems.** Giesekke, E.W. (National Institute for Metallurgy, Johannesburg, South Africa). 1981. National Physical Research Laboratory, CSIR, P.O. Box 395, Pretoria, 0001, South Africa.

From Symposium on surface science and its industrial implications; Pretoria, South Africa (1 Nov 1981).

A study of the adsorbed species at the interface between the minerals and the aqueous solution is reported in the hope that it will contribute to a better understanding of selective mineral flotation by various reagents. The results of infrared spectroscopic studies are cited from the author's investigation on the fluorite-sodium oleate and fluorite-linoleate systems. Electron-spectroscopic techniques, e.g., electron spectroscopy for chemical analysis (ESCA) have also been useful in the identification of adsorbed species on mineral surfaces. Some experimental data from the literature are discussed. These studies have the disadvantage that they are not in situ investigations of the interface between the mineral and the aqueous solution. The potential use of other spectroscopic techniques are discussed, photo-acoustic, Raman, and electron-spin-resonance spectroscopy being considered as possible alternatives. It is suggested that the relatively small surface areas of minerals used in

flotation (i.e. smaller than $2m^3.g^{-1}$) impose severe restrictions on the use of such techniques.

46830 (CONF-8506155—, pp 119-122) **Chemical and toxicological characterization of neutral components in coal-gasification condensates.** Stamoudis, V.C.; Haugen, D.A.; Hefley, P.D.; Picel, K.C.; Eikens, D.I.; Demirgian, J.C. (Argonne National Lab., IL). 1985. NTIS, PC A06/MF A01. File Number DE85016336.

From Health and environmental effects of complex chemical mixtures; Chicago, IL, USA (17 Jun 1985).

We have characterized some of the neutral components in two coal-gasification condensates, one from the Grand Forks Energy Technology Center (GFETC) slagging, fixed-bed gasifier and the other from the Morgantown Energy Technology Center (METC) fixed-bed gasifier. 2 tabs. (DT)

46831 (DOE/ER/05173—T1) **Non-destructive determination of trace elements. Final progress report.** Anderson, D.L.; Gordon, G.E.; Zoller, W.H.; Walters, W.B.; Lindstrom, R.M. (Maryland Univ., College Park (USA). Dept. of Chemistry; National Bureau of Standards, Washington, DC (USA). Center for Analytical Chemistry). May 1984. Contract AS05-76ER05173. 30p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85017210.

In the course of this project we have successfully designed, built, and tested the first neutron beam facility dedicated to routine multielement neutron capture prompt-$\gamma$ activation analysis (PGAA). This technique is capable of accurately measuring concentrations of up to 20 elements in a number of sample types, and is an extremely valuable complement to instrumental neutron activation analysis (INAA) and other analytical methods. We have found PGAA to have some major advantages over INAA: (1) the sample is subjected to neutron fluxes about five orders of magnitude less than in PGAA, with essentially no radiation or heating damage; (2) as the data are taken during sample irradiation, analyses can be performed immediately instead of waiting up to four weeks as in INAA; (3) it is capable of measuring all major elements, except oxygen, in many samples, including H, C, N, and Si, which cannot be done by INAA; and (4) it is especially sensitive for the trace elements B, Cd, Sm and Gd. In addition, we have characterized the overall capabilities of PGAA and the corrections necessary to make it an extremely accurate technique. We have applied PGAA in a number of studies in which it has proved to be extremely valuable and, at times, even providing crucial information that other techniques were incapable of supplying. 1 fig., 6 tabs.

46832 (DOE/ER/13127—05) **Capillary separations with calorimetric absorbance detection. Technical progress report, September 1, 1984-August 31, 1985.** Sepaniak, M.J. (Tennessee Univ., Knoxville (USA). Dept. of Chemistry). 1985. Contract AS05-83ER13127. 8p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85017414.

In this progress report on the development of capillary columns for liquid chromatographic systems, development of packed fused silica microcolumns, open tubular capillary columns, thermooptical detectors and photoionization flow cells are described. 2 refs., 2 figs. (DT)

46833 (DOE/LC/10845—1828) **Sample conditioning and standard preparation for synfuel gas analysis.** Wallace, J.R.; Nye, R.A. (Denver Research Inst., CO (USA)). Mar 1985. Contract AS20-82LC10845. 25p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85010073.

A goal of the work carried out subsequent to the field test was thus to develop a method of collecting and conditioning a gas sample which obviated these concerns. The method was to avoid exposing the gas to any liquid condensate, and was to be insensitive to high loadings of suspended dust or droplets, and should not be affected by pressure fluctuations which inevitably occur in a process line. For this purpose a volumetric gas dilutor was developed. This system extracts a fixed volume of gas at constant pressure and temperature and dilutes it with another inert carrier gas. The critical component of this system was designed and tested in the laboratory as described in Section 2 of this report. Finally, a detailed design for a fieldworthy gas conditioning system was completed to the level of individual components and vendors. A summary of this design was provided to LETC in the June 1983 monthly report, but the system was not developed further. The volumetric dilution system also appears to be a valuable method for preparing gas standards in the range 0.1 ppM to ca. 20%. In much of this range the accuracy of this standard can be traceable to NBS standards. Dilution of a fluid by means of repetitive injections of a fixed volume into a diluent stream requires that the resulting concentration spikes be averaged over time. This chapter shows that a single mixing chamber is normally inadequate, but that a column of 5 to 20 "plates" or sub-volumes is optimum. 7 figs., 2 tabs.

46834 (GKSS—85/E/11) **Cross-section measurements of Cr, Mn, Fe, Co, and Ni for the accurate determination of these elements in natural and synthetic samples using a 14 MeV neutron generator.** Bahal, B.M.; Pepelnik, R. (GKSS-Forschungszentrum Geesthacht G.m.b.H., Geesthacht-Tesperhude (Germany, F.R.)). 1985. 45p. B. File Number DE85752247.

Due to the essential role palyed by these metals in the biological functions, their accurate determination in natural samples is important. Using a 14 MeV neutron generator for activation, especially the analysis of these elements becomes problematic, caused by the interference from the neighbouring elements producing the same isotopes via different reaction channels. To find the optimal reactions with high sensitivity and low interference all useful reaction cross-sections were measured precisely. A detailed error analysis has been made. The accuracy of the 14 MeV neutron activation analysis was checked for these elements in several known mixtures. Inspite of the large interference in several cases, it was possible to determine the concentrations to an accuracy of better than 4%.

46835 (IAEA-TECDOC—330) **Health-related monitoring of trace element pollutants using nuclear techniques. Results of co-ordinated research programmes on nuclear methods for health-related monitoring of trace element pollutants and health-related environmental research using nuclear techniques.** (International Atomic Energy Agency, Vienna (Austria)). Mar 1985. vp. NTIS (US Sales Only), PC A11/MF A01. File Number DE85781626.

Separate abstracts were prepared for papers from this volume on the results of coordinated research on nuclear methods for health and environmental related monitoring.

46836 (INIS-mf—9740, pp 129) **Rapid analysis of phosphate rocks and related materials using an ICP spectrometer.** Hoffer, D.; Brenner, I.B.; Halicz, L. (Ministry of Energy and Infrastructure, Jerusalem (Israel). Geological Survey of Israel). 1984. NTIS (US Sales Only), PC A11/MF A01. File Number DE85781539. (CONF-8404250—Absts.).

From 50. anniversary meeting of the Israel Chemical Society; Jerusalem, Israel (10 Apr 1984).

Published in summary form only.

46837 (INIS-mf—9742, pp 6-16) **Current state and prospects of activation autoradiography development.** Gusakov, A.A.; Babikova, Yu.F.; Kazakov, S.S.; Minaev, V.M. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow). 1983. (In Russian). NTIS (US Sales Only), PC A12/MF A01. File Number DE85781598. (CONF-8305206—).

From 13. international symposium on autoradiography; Tabor, Czechoslovakia (2 May 1983).

The uses of autoradiography have broadened with the use of the activation of samples with neutrons, gamma radiation or charged particles. It is specially advantageous for the monitoring and testing of distribution of light elements in construction materials and for monitoring the diffusion and self diffusion of light elements in metals, alloys and compounds. Most frequently used for detection are track detectors. Automated systems for recording quantitative characteristics from autoradiograms will ever more frequently be used for detection. The density of constrast autoradiograms is recorded with a microphotometer and the track density may be determined using television optical and electron micro-

scopes. The tables show examples of the determination of certain elements and give parameters of their nuclear reactions. (E.S.).

46838 (INIS-mf—9742, pp 17-24) **Some theoretical aspects of autoradiographic radioactivity determinations of small point sources.** Wilczynski, A.W.; Kowalczyk, J.T. (Uniwersytet Slaski, Katowice (Poland)). 1983. NTIS (US Sales Only), PC A12/MF A01. File Number DE85781598. (CONF-8305206—).

From 13. international symposium on autoradiography; Tabor, Czechoslovakia (2 May 1983).

Quantitative autoradiography is a convenient method which allows to determine the radiotracer concentration in small zones of investigated samples. When the investigated zones are smaller than the resolution of used photographic film, the interpretation of autoradiographs is difficult. A theoretical analysis is presented of autoradiographic pictures received from small point sources of radiation. It was found that the form of the curve optical density-distance from the center of symmetry of the peak carries the information about radioactivity of the source. It is possible to determine the distance between the film and the source of radiation. Simultaneously it was found that the maximum optical density and the area under the curve are not sufficient for the determination of the source radioactivity. These considerations were applied to the interpretation of autoradiographs obtained from particles of $Al_2O_3$ traced with cerium. (author).

46839 (INIS-mf—9742, pp 25-33) **Ion-beam images in gelatine.** Varga, Z.; Somogyi, G.; Hunyadi, I. (Magyar Tudomanyos Akademia, Debrecen. Atommag Kutato Intezete); Ilic, R.; Loose, A. (Institut Jozef Stefan, Ljubljana (Yugoslavia)). 1983. NTIS (US Sales Only), PC A12/MF A01. File Number DE85781598. (CONF-8305206—).

From 13. international symposium on autoradiography; Tabor, Czechoslovakia (2 May 1983).

Image formation properties of gelatine layers have been studied for different nuclear particles (electrons, protons, alphas). The threshold values of particle fluences for producing stable relief images observable using an optical microscope have been determined by studying the dissolution rate of irradiated gelatine layers. It has been found that the dissolution behaviour of gelatine is very similar to that of the lithographic polymer resists (e.g. PMMA, PBS). A method is developed to improve the contrast of ion-beam images by using proper dyeing techniques. The high spatial resolution of the novel radiographic method is shown in some typical fields of application (e.g. ion-beam lithography, neutron-induced autoradiography). (author).

46840 (INIS-mf—9742, pp 48) **Study of the possibility of nitrogen mapping by CR-39 track detectors.** Somogyi, G.; Varga, Z. (Magyar Tudomanyos Akademia, Debrecen. Atommag Kutato Intezete); Freyer, K.; Treutler, H.Ch. (Akademie der Wissenschaften der DDR, Leipzig. Zentralinstitut fuer Isotopen- und Strahlenforschung). 1983. NTIS (US Sales Only), PC A12/MF A01. File Number DE85781598. (CONF-8305206—).

From 13. international symposium on autoradiography; Tabor, Czechoslovakia (2 May 1983).

Published in summary form only.

46841 (INIS-mf—9742, pp 49-51) **Nitrogen autoradiography using track detectors.** Gusakov, A.A.; Minaev, V.M.; Ryabova, G.G. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow). 1983. (In Russian). NTIS (US Sales Only), PC A12/MF A01. File Number DE85781598. (CONF-8305206—).

From 13. international symposium on autoradiography; Tabor, Czechoslovakia (2 May 1983).

Steel samples with nitrogen content were irradiated in the thermal channel of the IRT-2000 reactor with a neutron flux density of 2.9 x $10^{11}$ $cm^{-2}s^{-1}$. Protons from the nuclear reaction $^{14}N(n,p)^{14}C$ were detected with a cellulose acetobutyrate track detector. This method may be used for determining nitrogen in any matrix in the absence of interfering elements lithium, boron, uranium and plutonium. Two track autoradiograms of the distribution of nitrogen in two types of steel are given. The amount of nitrogen was 0.9 and 0.04 wt.% and the samples were irradiated with a neutron fluence of $10^{18}$ and 3 x $10^{18}$ $cm^{-2}$, respectively. (E.S.).

46842 (INIS-mf—9742, pp 52-56) **Track autoradiography of $^3He$ from $^3He(n,p)^3H$ reaction.** Artemenkov, I.L.; Goncharov, E.E.; Ryabova, G.G.; Sorochan, D.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow). 1983. (In Russian). NTIS (US Sales Only), PC A12/MF A01. File Number DE85781598. (CONF-8305206—).

From 13. international symposium on autoradiography; Tabor, Czechoslovakia (2 May 1983).

The distribution of $^3He$ in samples is detected by autoradiography. Silicon samples partly covered with a thin layer of $SiO_2$ were implanted with $^3He$ ions. After implantation the $SiO_2$ layer was etched away and the samples were irradiated with thermal neutrons in the IRT-2000 MIFI reactor with a fluence of 2.5 x $10^{15}$ $cm^{-2}$. Cellulose acetatobutyrate and cellulose nitrate track detectors were used for proton detection in the $^3He(n,p)^3H$ nuclear reaction. (E.S.).

46843 (INIS-mf—9742, pp 168-173) **Determination of boron concentration in silicon single crystals by neutron-induced alpha autoradiography.** Koscis, Zs. (University of Chemical Engineering, Department of Radiochemistry, Veszprem (Hungary)). 1983. NTIS (US Sales Only), PC A12/MF A01. File Number DE85781598. (CONF-8305206—).

From 13. international symposium on autoradiography; Tabor, Czechoslovakia (2 May 1983).

The possibility of boron determination in silicon single crystals was examined in the $10^{16}$ to $10^{20}$ B atom/$cm^3$ concentration range using neutron induced alpha radiography. Samples were irradiated in a nuclear reactor at a thermal neutron fluence of $10^{10}$ to $10^{12}$ n/$cm^2$ and a cadmium ratio of 30. As alpha-sensitive track detectors KODAK LR-115 and Makrofol E were used. The results indicated that under the conditions used boron could be determined in the $10^{17}$ to $10^{20}$ B atom/$cm^3$ concentration range. The Makrofol E detector could be used to advantage in the upper range while the Kodak LR-115 foil in the lower range of this concentration. (author).

46844 (INIS-mf—9742, pp 174-180) **Determination of lateral boron distribution in large silicon disks by neutron-induced autoradiography.** Weisse, S.; Freyer, K. (Akademie der Wissenschaften der DDR, Leipzig. Zentralinstitut fuer Isotopen- und Strahlenforschung). 1983. (In German). NTIS (US Sales Only), PC A12/MF A01. File Number DE85781598. (CONF-8305206—).

From 13. international symposium on autoradiography; Tabor, Czechoslovakia (2 May 1983).

The development, modification and testing of procedures used in the production of semiconductors indispensably requires analytical procedures for determining the distribution homogeneity of the doping agent. Neutron induced autoradiography allows the imaging of the surface distribution of boron also on relatively large Si discs. The method is described of the determination of boron content and distribution in Si discs of a 2.3 and 4 inch diameter respectively, using a 3 mg $^{252}Cf$ neutron source. The problems are discussed related to sample handling, irradiation configuration, etching and evaluation of autoradiograms obtained with dielectric track detectors. The described procedure is demonstrated on examples of applications. (Ha).

46845 (INIS-mf—9742, pp 186-188) **Homogeneous Au depositions on silicon.** Janu, M.; Stverak, B.; Kopejtko, J. (Ustav pro Vyzkum, Vyrobu a Vyuziti Radioisotopu, Prague (Czechoslovakia)). 1983. (In German). NTIS (US Sales Only), PC A12/MF A01. File Number DE85781598. (CONF-8305206—).

From 13. international symposium on autoradiography; Tabor, Czechoslovakia (2 May 1983).

For purposes of semiconductor production the homogeneity of Au adsorption from its solution in aqua regia on Si discs was studied autoradiographically. The presented examples show that a greater amount of gold is deposited on the disc boundaries and that

gold deposition depends on the type of conductivity (p or n). The given examples show that gold distribution after diffusion into base material is not homogeneous. (Ha).

46846 (INIS-mf—9742, pp 189) **Autoradiographic studies of synthetic quartz.** Jurisch, M.; Hermann, U. (Academy of Sciences of GDR, Central Institute of Solid State Physics and Materials Sciences, Dresden). 1983. NTIS (US Sales Only), PC A12/MF A01. File Number DE85781598. (CONF-8305206—).

From 13. international symposium on autoradiography; Tabor, Czechoslovakia (2 May 1983).

Published in summary form only.

46847 (INIS-mf—9742, pp 198-209) **Quantitative autoradiography of water labelled with tritium.** Joks, Z.; Krejci, M.; Menclova, B. (Statni Vyzkumny Ustav Materialu, Prague (Czechoslovakia)). 1983. NTIS (US Sales Only), PC A12/MF A01. File Number DE85781598. (CONF-8305206—).

From 13. international symposium on autoradiography; Tabor, Czechoslovakia (2 May 1983).

A method for the quantitative determination of water concentration in plastics is described. It is based on comparison of the optical densities of autoradiograms obtained from standards the tritium contents of which is known to those obtained from samples for which the tritium content or concentration is to be found. The tritium densitometric curve is shown which was obtained from two standards using different exposure times. The method was used to determine the concentration of water penetrated into various plastic materials based on polyester resins. The main advantage of the described method is the possibility to determine topical concentration of water. (author).

46848 (INIS-mf—9742, pp 210) **Study of alpha-activity distributions in environmental samples by CR-39 track detectors.** Hunyadi, I.; Somogyi, G.; Szilagyi, S. (Magyar Tudomanyos Akademia, Debrecen. Atommag Kutato Intezete). 1983. NTIS (US Sales Only), PC A12/MF A01. File Number DE85781598. (CONF-8305206—).

From 13. international symposium on autoradiography; Tabor, Czechoslovakia (2 May 1983).

Published in summary form only.

46849 (INIS-mf—9742, pp 215) **Neutron induced and alpha autoradiography of rocks.** Medveczky, L. (Magyar Tudomanyos Akademia, Debrecen. Atommag Kutato Intezete). 1983. NTIS (US Sales Only), PC A12/MF A01. File Number DE85781598. (CONF-8305206—).

From 13. international symposium on autoradiography; Tabor, Czechoslovakia (2 May 1983).

Published in summary form only.

46850 (JINR—18-84-392) **Application of gamma-activation analysis to the investigation of the earth ancient crystalline rocks.** Ehrnandes, A.; Zhuravleva, E.L.; Nartikoev, V.D.; Ehlevich, V.Ya. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions). 1984. 14p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE85702113.

Application of bremsstrahlung and photoneutrons from a microtron for multielement activation analysis of samples of the Earth ancient crystallized rocks was investigated. Nearly 30 elements have been determined mostly by the instrumental photon activation analysis, but instrumental thermal neutron activation analysis has been also applied for determining several elements in the samples. The optimal irradiation regimes and both cooling and measuring times were established. Sensitivity and accuracy of the analysis are presented. The experimental data are in satisfactory agreement with the results obtained by 5 other different analytical methods.

46851 (RFP—3802) **Solvent extraction of plutonium (IV) polymer by organophosphorus compounds.** Muscatello, A.C.; Navratil, J.D.; Killion, M.E. (Rockwell International Corp., Golden, CO (USA). Rocky Flats Plant). 23 Mar 1985. Contract AC04-76DP03533. 17p. (CONF-850417—27). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85013229.

From 189. national meeting of the American Chemical Society; Miami, FL, USA (28 Apr 1985).

We have recently discovered bifunctional organophosphorus reagents and TOPO(trioctylphosphine oxide) extract hydrolytic plutonium (IV) polymer from 0.1 to 7.0 M nitric acid. Other extractants are not effective in the extraction of the polymer. The extraction behavior of the polymer with octylphenyl-N,N-diisobutylcarbamoylmethylphosphine oxide(OOD[IB]CMPO), both alone and mixed with TBP(tri-n-butylphosphate) and with TOPO will be discussed. In addition, the extraction behavior with DHDECMP(Dihexyl-N,N-diethylcarbamoylmethylphosphonate) will be reviewed for comparison. In general, the extraction of the polymer increases with nitric acid concentration and is second-to-third power dependent on extractant concentration. The most efficient stripping agent is 1.0 M sodium carbonate. 1 ref.

46852 (RHO-SS-SA—18P) **Simulation of glovebox nondestructive assay to aid in error estimation and measurement procedure design.** Eggers, R.F.; Giese, E.W.; Jones, R.A.; Kerns, R.E. (Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations). 19 Jul 1985. Contract AC06-77RL01030. 8p. (CONF-850765—33). NTIS, PC A02/MF A01; GPO Dep. File Number DE85017242.

From 26. annual meeting of the Institute of Nuclear Materials Management; Albuquerque, NM, USA (21 Jul 1985).

Gamma ray nondestructive assay (NDA) measurement procedures for large objects such as gloveboxes require that multiple measurements be made to cover the entire object. Net counts observed at each measurement location are converted to special nuclear material (SNM) equivalents using a data reduction equation. To facilitate rapid and reliable reduction of data, this equation is often a simple representation of the measurement situation. Using a single measurement procedure applied uniformly to many situations and a simple data reduction equation produce results that only approximate the quantity of SNM contained in the glovebox. This paper discusses a glovebox measurement simulation model and computer program that is being developed by Rockwell Hanford Operations. The model is being used to investigate some of the errors associated with current measurement and data reduction procedures. 6 figs.

46853 (RISO-R—517, pp 11-63) **Condensed matter physics.** Feb 1985. NTIS (US Sales Only), PC A05/MF A01. File Number DE85781588.

In Physics Department annual progress report 1 January-31 December 1984.

The condensed matter physics research in the Physics Department of Risoe National Laboratory is predominantly experimental utilising diffraction of neutrons and x-rays. The research topics range from studies of structure, excitations and phase transitions in model systems to studies of ion transport, texture and recrystallization kinetics with a more applied nature.

46854 (Y/DK—416) **Nuclear magnetic resonance (NMR) analysis of a Kel-F resin and lacquer.** Rutenberg, A.C. (Oak Ridge Y-12 Plant, TN (USA)). 2 Aug 1985. Contract AC05-84OS21400. 24p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016979.

Proton, carbon, and fluorine nuclear magnetic resonance (NMR) spectroscopy has been used at the Oak Ridge Y-12 Plant to determine the concentration of various species present in Kel-F 800 resin and its lacquers. Nuclear magnetic resonance (NMR) spectroscopy has been used to characterize Kel-F 800 resin and to measure the various chemical species present in a lacquer based on this resin. Proton NMR spectroscopy was used to measure the ratio of ethyl acetate to xylenes and to estimate the vinylidene fluoride content of the resin. Fluorine NMR spectroscopy was used to determine the water and ethanol content of the lacquer as well as some of its components. Fluorine NMR spectroscopy was also used to estimate the amount of perfluorodecanoate emulsifier present in the Kel-F resin. Carbon-13 NMR spectroscopy was used to determine the isomeric composition of various batches of xylenes and as an alternate method for measuring the vinylidene fluoride content of the resin. 3 refs., 12 figs., 1 tab.

**46855 Identification of polycyclic aromatic hydrocarbon metabolites in mixtures using fluorescence line narrowing spectrometry.** Sanders, M.J.; Cooper, R.S.; Small, G.J.; Heisig, V.; Jeffrey, A.M. (Iowa State Univ., Ames). *Analytical Chemistry;* **57**: No. 6, 1148-1152(May 1985).

The direct identification of all six components in a laboratory mixture of polycyclic aromatic hydrocarbon (PAH) metabolites using fluorescence line narrowing (FLN) spectrometry is described. Metabolites are identified by comparison to standard spectra of the pure compounds. In addition, it is demonstrated that the sensitivity of the technique is adequate for the identification of PAH metabolite - DNA adducts at a level of ~5 adducts per $10^6$ bases. Typically, using cells in culture, DNA damage levels from PAH carcinogens are ~1 adduct per $10^5$ - $10^6$ base pairs. The potential for the analysis of complex mixtures of DNA adducts is discussed. 22 references, 7 figures, 1 table.

**46856 Direct fissile assay of enriched uranium using random self-interrogation and neutron coincidence response.** Menlove, H.O.; Stewart, J.E. (to Dept. of Energy). US Patent Application 6-697,989. 4 Feb 1985. 20p. Contract W-7405-ENG-36. DE85017794 NTIS, PC A02/MF A01; GPO Dep. File Number DE85017794.

Apparatus and method for the direct, nondestructive evaluation of the $^{235}U$ nuclide content of samples containing $UF_6$, $UF_4$, or $UO_2$ utilizing the passive neutron self-interrogation of the sample resulting from the intrinsic production of neutrons therein. The ratio of the emitted neutron coincidence count rate to the total emitted neutron count rate is determined and yields a measure of the bulk fissile mass. The accuracy of the method is 6.8% ($1\sigma$) for cylinders containing $UF_6$ with enrichments ranging from 6% to 98% with measurement times varying from 3-6 min. The samples contained from below 1 kg to greater than 16 kg. Since the subject invention relies on fast neutron self-interrogation, complete sampling of the $UF_6$ takes place, reducing difficulties arising from inhomogeneity of the sample which adversely affects other assay procedures. 4 figs., 1 tab.

**46857 Nucleonics.** Lyon, W.S.; Ross, H.H. (Oak Ridge National Lab., TN). *Analytical Chemistry;* **56**: No. 5, 83R-88R(Apr 1984). Contract W-7405-ENG-26.

A review of nucleonics indicates that other techniques in the analytical field, e.g. inductively coupled lasers, variations on the mass spec theme such as resonance ionization mass spectrometry, continue to push nuclear techniques aside and to claim analyses that were once the exclusive province of nuclear activation analysis. However, some persons continue to persevere in the face of much adversity in the nuclear analytical techniques. In this review, the new aspects of nucleonics and the books, data compilation, and conference proceedings are discussed. Here less emphasis has been placed on the source of information (highlighted in previous reviews) than on the information itself. Table entries have been limited to items that are of most interest to analytical chemist; and in the body of the text at least one or two innovative or potentially useful new techniques are described a bit more in detail.

**46858 Microdetermination of o-aminophenol and some substituted o-aminophenols using a copper ion-selective electrode.** Selig, W. (Lawrence Livermore National Lab., CA). *Microchemical Journal;* **28**: 126-131(1983). Contract W-7405-ENG-48.

The use of copper ion-selective electrode (ISE) and a single-junction reference electrode to monitor emf's has been extended to the determination of o-aminophenol and some substituted o-aminophenols. Standard solutions of either cupric sulfate or nitrate in aqueous or mixed aqueous-methanol medium were used. The o-aminophenols form a 2:1 amine:Cu complex; however, the m- and p-isomers do not react in this manner.

**46859 (CE-Trans—8081) Moessbauer spectroscopy in biology and medicine.** Ortalli, I. Translated from *Giornale di Fisica Sanitaria e Protezione Contro le Radiazioni ;* **23**: No. 4, 283-288(Oct-Dec 1982). 12p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85901460.

The Moessbauer applications in the biological field are essentially limited to compounds containing iron, tin, and iodine. The best known of these molecules are the haemoproteins. Information on the local structure and on the symmetry of the environment of the iron atom can be obtained from the quadrupole separation. This can sometimes also be of assistance for confirmation of the state of oxidation of the atom. 9 refs., 4 figs., 2 tabs.

## 4002 Inorganic And Physical Chemistry

*REFER ALSO TO CITATION(S) 46877, 46879, 46883, 46889*

**46860 (DOE/ER/04426—8) Kinetics of elementary atom and radical reactions. Progress report.** Gordon, R.J. (Illinois Univ., Chicago (USA)). Aug 1985. Contract AC02-77ER04426. 10p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85017167.

Our research program is concerned with the rates and mechanisms of elementary gas phase reactions and energy transfer involving polyatomic molecules. We report here on three ongoing projects: the reaction of oxygen atoms with hydrogen molecules, the chemistry of NH radicals, and the vibrational relaxation of highly excited $SF_6$ molecules.

**46861 (DOE/PC/60779—7) Advanced NMR characterization of zeolite catalysts. Seventh quarterly report, 1 April-30 June 1985.** Welsh, L.B. (Signal Research Center, Inc., Des Plaines, IL (USA)). Jun 1985. Contract FG22-83PC60779. 10p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016903.

The program discussed in this report is a two-year two-phase joint UOP-University of Illinois study of the application of improved high resolution solid state nuclear magnetic resonance (NMR) techniques to the characterization of zeolite catalysts. During the first phase of this program very pure, and in some cases isotopically enriched faujasites were prepared and studied by magic angle sample spinning NMR (MASS NMR) and variable angle sample spinning NMR (VASS NMR) on 500 and 360 MHz (Proton frequency) NMR spectrometers. The NMR techniques to be emphasized are the measurement and analysis of the $^{17}O$ NMR properties, $^{27}Al$ NMR intensity quantitation, and $^{27}Al$ and $^{29}Si$ NMR relaxation rates. During the second phase of this program some of these NMR techniques were used to study the effects of impurity concentration, dealumination treatments and cation exchange on the NMR properties of faujasites. The main emphasis of this program during Phases I and II has been on the preparation and measurement of the NMR properties of $^{17}O$ enriched Na-Y faujasites. The effort in each phase is broken into four tasks: (1) zeolite preparation; (2) standard zeolite characterization; (3) measurement of zeolite NMR properties; and (4) analysis of NMR data. The main efforts during the seventh three-month period of the program have been in four areas: (1) manuscript preparation of the $^{17}O$ NMR results for faujasites; (2) synthesis of $^{17}O$ enriched AlPO-n microporous materials; (3) $^{17}O$ NMR studies of $^{17}O$ enriched $AlPO_4$-5; and (4) preliminary spin-lattice relaxation rate measurements of $^{17}O$ enriched zeolites. 3 figs.

**46862 (INIS-SU—300) 6. Soviet-French seminar on catalysis. Collection of reports.** (AN SSSR, Moscow; AN SSSR, Moscow. Nauchnyj Sovet po Katalizu). 1983. 174p. (In Russian). NTIS (US Sales Only), PC A08/MF A01. File Number DE85781600.

From 6. Soviet-French seminar on catalysis; Moscow (USSR) (1983).

Selected papers have been processed for inclusion in the Energy Data Base.

**46863 (JAERI-M—84-143) MPEC: multi-phase equilibrium chemical code by free energy minimization method.** Uchida, Masaaki. (Japan Atomic Energy Research Inst., Tokyo). Aug 1984. 24p. (In Japanese). NTIS (US Sales Only), PC A02/MF A01. File Number DE85702233.

A multi-phase equilibrium chemical code MPEC was developed. The code calculates equilibrium composition of chemical species under given combination of elements using the principle of minimum free energy. Slow convergence of the conventional nu-

merical method was improved by adopting the logarithm of activity as independent variable. The problem of numerical instability accompanying the increased convergence speed was resolved by careful setting of initial guess values: before the calculation for the equilibrium composition is started, the outline of the composition is guessed by the linear programing method. This method has proven particularly effective for such complex problems as that existence or disappearance of many phases is determined by subtle balance of elements. In such problems, the calculation time of MPEC was found to be about 100 times as fast as that of a code based on the conventional numerical method.

**46864 (JINR—14-84-536) New crystallographic data on phase transitions in hydro- and deuterosulphate of cesium.** Balagurov, A.M.; Belushkin, A.V.; Wosicki, J.; Natkaniec, I.; Plakida, N.M.; Savenko, B.N.; Datt, I.D.; Shuvalov, L.A.; Shchagina, N.M. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics). 1984. 4p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE85702115.

The phase tansitions in $CsHSO_4$ and $CsDSO_4$ crystalline compounds were investigated by the neutron diffraction method (making use of the time-of-flight method of studying single and polycrystal samples. The existence of three (1, 2, 3) phases in $CsHSO_4$ and of two in $CsDSO_4$ in the 123-420 K temperature range (1-superionic, high-temperature; 2-intermediate; 3-low temperature phases) is established. The diffraction diagrams point to a possible identity of crystal structure in the phases 2 for both compounds. The crystallographic data are determined for phase 2 of $CsDSO_4$:a=7.302(5), b=8.092(5), c=3.834(5) $\beta$=98.5(1) deg, z=2; the space group is $P2_1/m$ or $P2_1$. In $CsHSO_4$ phase 2 is metastable. A strong correlation between the kinetics of transition 3 $\rightarrow$ 2 and the quantity of adsorbed water is established.

**46865 (LA-UR—85-2833) Comments concerning the crystal structure of $B_4C$.** Larson, A.C. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 6p. (CONF-850786—3). NTIS, PC A02/MF A01; GPO Dep. File Number DE85017566.

From International conference on the physics and chemistry of boron and boron-rich borides; Albuquerque, NM, USA (29 Jul 1985).

The crystal structure of $B_4C$ at ~20 atom% carbon is reported. The space group is R 3m, hexagonal cell lattice constants are a=5.6039(4)A, c=12.0786(14)A, v=109.50A$^3$, Z=3, $\mu$(MoK$\alpha$)=0.05 mm$^{-1}$. The excess carbon above the stoichiometric composition of $B_{13}C_2$ replaces up to 1/6 of the boron in the rhombohedral boron site (B2). The results this refinement are reported and compared with earlier results reported on lower carbon samples. Evidence is that the icosahedron is essentially pure boron at and below carbon compositions of 13.3 a%. 8 refs., 5 tabs.

**46866 (NP—5770370) Poisoning of noble metal catalysts by arsenic and silicon compounds in an oxidizing atmosphere.** Kaizik, A. (Technische Univ. Muenchen (Germany, F.R.). Fakultaet fuer Chemie, Biologie und Geowissenschaften). 12 Jan 1984. 206p. (In German). NTIS (US Sales Only), PC A10/MF A01. File Number DE85770370.

The dissertation deals with the poisoning of noble metal catalysts by arsenic and silicon compounds in an oxidizing atmosphere. The problem was studied in the field of catalytic exhaust and waste air post-combustion, but the findings can be applied to other catalytic processes in which arsenic and silicon compounds may occur as catalyst poisons. The following issues were investigated: 1. Kinetics of arsenic and silicon poisoning of platinum-containing carrier catalysts; 2. Regeneration of poisoned catalysts; 3. mathematical modelling of the poisoning processes.

**46867 (ORNL/TM—9586) Density study of the ternary mixture $Mg(NO_3)_2$-$HNO_3$-$H_2O$.** Jubin, R.T.; Marley, J.L.; Counce, R.M. (Oak Ridge National Lab., TN (USA)). Jun 1985. Contract AC05-84OR21400. 22p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85018124.

Densities for the $Mg(NO_3)_2$-$HNO_3$-$H_2O$ system have been experimentally measured; more than 140 measurements were made covering ranges of 30 to 70 wt % $Mg(NO_3)_2$, 0 to 40 wt % $HNO_3$, and temperatures of 50 to 145°C. A mathematical model for the observed density relationships has been developed. 6 refs., 3 figs., 8 tabs.

**46868 Multiplet splitting (broadening) of the Ru L/sub II,tsIII/ edge white lines in the x-ray absorption near edge spectra of $Ru(NH_3)_6Cl_3$.** Sham, T.K. (Department of Chemistry, Brookhaven National Laboratory, Upton, New York 11973). *Journal of Chemical Physics;* **83**: No. 7, 3222-3224(1 Oct 1985).

It is shown that the linewidth broadening of the Ru L/sub II,tsIII/ edge white lines of $Ru(NH_3)_6Cl_3$ can be accounted for on the basis of final state multiplet splitting. The spread in the final state exchange energy has been calculated to be ~ 0.5 eV, which is in reasonable accord with the observed broadening.

**46869 Synthetic and structural chemistry of gadolinium and holmium catecholates.** Freeman, G.E.; Raymond, K.N. (Univ. of California, Berkeley). *Inorganic Chemistry;* **24**: No. 9, 1410-1417(24 Apr 1985). Contract AC03-76SF00098.

As part of a study to characterize the complexes formed by catechol (1,2-dihydroxybenzene) with lanthanides in aqueous solution, crystalline samples of three gadolinium(III) complexes and a holmium(III) complex have been prepared and characterized by structural, analytical, and spectroscopic techniques. Only 1:1 complexes are isolated at pH < 8, but bis-, tris- and tetrakis(catecholato)gadolinium complexes have been prepared in basic (pH > 11) solutions. The structures of tris- and tetrakis(catecholate)gadolinium compounds have been determined by single-crystal X-ray diffraction methods using counter data. Molecular and crystal structure data are tabulated.

**46870 Synthesis and crystal and molecular structure of cis-dioxodichloro[diisopropyl(N,N-diethylcarbamyl)methylenephosphonate]molybdenum(VI).** Bowen, S.M.; Duesler, E.N.; McCabe, D.J.; Paine, R.T. (Univ. of New Mexico, Albuquerque). *Inorganic Chemistry;* **24**: No. 8, 1191-1194(10 Apr 1985).

cis-Dioxodichloro[diisopropyl (N,N-diethylcarbamyl)methylenephosphonate]molybdenum(VI), $MoO_2Cl_2[(i\text{-}C_3H_7O)_2P(O)\text{-}CH_2C(O)N(C_2H_5)_2]$, has been prepared from the addition of $MoO_2Cl_2$ to the phosphonate ligand in ethanol. The resulting complex has been characterized by infrared and $^1H$, $^{13}C\{^1H\}$, and $^{31}P\{^1H\}$ NMR spectroscopy and single-crystal X-ray diffraction analysis. The crystal parameters for the complex are presented. The structure was solved by heavy-atom techniques, and blocked least-squares refinement converged with R/sub F/ = 3.3% and R/sub wF/ = 3.4% for 3502 unique reflections with F $\geq$ 5$\sigma$(F). The structure contains monomeric units of the complex with the six-coordinate Mo atom having a pseudooctahedral coordination geometry. The carbamylmethylenephosphonate ligand is bonded to the Mo atom in a bidentate manner. Several important bond distances for molybdenum bonded to other elements are given.

**46871 Solubility of carbon monoxide in 1,4-dioxane.** Veleckis, E.; Hacker, D.S. (Argonne National Lab., IL). *Journal of Chemical and Engineering Data;* **29**: No. 1, 36-39(1984).

The solubility of CO in 1,4-dioxane was determined as a function of pressure (7-70 atm) and temperature (80-173°C). An expression is given for solubility that relates the mole fraction and partial pressure of CO (in atmospheres) and the temperature in degrees Kelvin. The results, analyzed in terms of the Krichevsky-Ilinskaya equation, showed that the partial molar volume of CO was independent of pressure and that the isobaric Henry's law was obeyed in the ranges studied. Comparisons with other solvents showed that, on the basis of CO dissolution characteristics, 1,4-dioxane can be classified better with polar than with nonpolar solvents.

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**46872** **Enzyme system generation of singlet ($^1m$/sub g/) molecular oxygen observed directly by 1.0-1.8-μm luminescence spectroscopy.** Khan, A.U. (Florida State Univ., Tallahassee). *Journal of the American Chemical Society;* **105**: No. 24, 7195-7197(1983). Contract AS05-78EV05855.

The observation of a strong singlet molecular oxygen luminescence emission in the ir produced in the decomposition of hydrogen peroxide by the enzymes lactoperoxidase, catalase, and chloroperoxidase is reported. A mixture of $H_2O$ and $D_2O$ was used as a reaction media. The luminescence emission spectra of the lactoperoxidase/$H_2O_2$ and chloroperoxidase/$H_2O_2$ were found to exhibit a single emission band at 1.28 μm for the former and three bands for the latter - a strong band at 1.30 μm and a possible weak band extending from the long-wavelength edge of the monochromator at 1.60 to 1.45 μm. The peak at 1.28 μm is absent in the catalase/$H_2O_2$ spectrum, but the peak at 1.64 μm is very evident. The spectra are interpreted as indicating the generation of free singlet oxygen (peak at 1.28 and 1.30 μm) in the case of the first two enzymes/$H_2O_2$ systems and the generation of predominately bound singlet molecular oxygen in the case of catalase/$H_2O_2$.

## 4003 Organic Chemistry

*REFER ALSO TO CITATION(S) 45938, 45939, 45950, 45972, 46854, 46862, 46869, 46870, 46871, 46883, 46889, 46899, 47349, 47352*

**46873** **(AD-A—154545/8/XAB) Hydrolysis of bromodifluoro-methyltriphenylphosphonium bromide.** Burton, D.J.; Flynn, R.M.; Manning, R.G.; Kessler, R.M. (Iowa State Univ. of Science and Technology, Ames (USA). Dept. of Chemistry). 1982. 7p. NTIS, PC A02/MF A01.

Hydrolysis of Ph3P(+)$CF_2$BrBr(-) afforded a high yield of bromodifluoromethane and triphenylphosphine oxide. Hydrolysis in the presence of a radioactive isotope of bromine or sodium iodide gave unequivocal evidence that the mechanism for this reaction proceeds through a difluorocarbene intermediate.

**46874** (CONF-8506155—, pp 109-114) **Preparation of specific chemical class fractions ad analytical support for toxicologic studies of energy related complex mixtures.** Wilson, B.W.; Wright, C.W.; Chess, E.K.; Later, D.W.; Bean, R.M. (Battelle Pacific Northwest Lab., Richland, WA). 1985. NTIS, PC A06/MF A01. File Number DE85016336.

From Health and environmental effects of complex chemical mixtures; Chicago, IL, USA (17 Jun 1985).

This report is concerned with preparation and analysis of the hydroaromatic and nitrogen-containing polycyclic aromatic compound (NPAC) fractions that are currently being used in initiation/promotion and chronic skin painting studies to determine dermal carcinogenicity in mice. We also report on development of methods for determination of DNA adducts formed from exposure to certain chemical class fractions, as well as on recent efforts to synthesize and characterize, both chemically and toxicologically, certain nitro-PAC formed during combustion of coal. 4 refs., 5 figs. (DT)

**46875** (CONF-8506155—, pp 115-118) **Dermal tumorigen PAH and complex mixtures for biological research.** Griest, W.H.; Guerin, M.R.; Ho, C. (Oak Ridge National Lab., TN). 1985. NTIS, PC A06/MF A01. File Number DE85016336. Contract AC05-84OR21400.

From Health and environmental effects of complex chemical mixtures; Chicago, IL, USA (17 Jun 1985).

Thirteen commercially available, commonly reported four-five ring dermal tumorigen PAHs, were determined in a set of complex mixtures consisting of crude and upgraded coal liquids, and petroleum crude oils and their distillate fractions. Semi-preparative scale, normal phase high performance liquid chromatographic fractionation followed by capillary column gas chromatography or gas chromatography-mass spectroscopy were used for the measurements. Deuterated or carbon-14 labeled PAH served as internal standards or allowed recovery corrections. Approaches for the preparation and measurement of radiolabeled PAH were examined to provide chemical probes for biological study. Synthetic routes for production of $^{14}C$ labeled dihydrobenzo[a]pyrene and $^{14}C$- or $^3H$ 10-azabenzo[a]pyrene are being studied to provide tracers for fundamental studies in tracheal transplant and skin penetration systems. (DT)

**46876** **(DOE/ER/13005—1) Ligand intermediates in metal catalyzed CO reduction. Final technical report, July 1, 1982-June 30, 1985.** Gladysz, J.A. (Utah Univ., Salt Lake City (USA). Dept. of Chemistry). 1985. Contract AC02-82ER13005. 24p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85017047.

The principal goal of this project is the preparation and physical and chemical characterization of stable complexes containing reactive ligand types believed to be intermediates in metal catalyzed CO and $CO_2$ reduction. We report on: (1) the chemistry of formyl complexes; (2) synthesis and reactivity of α-hydroxyalkyl complexes; (3) synthesis and chemistry of formaldehyde complexes; (4) chemistry of formate complexes; (5) synthesis and crystal structure of a stable $=CH_2$ complex; (6) coupling of coordinated $=CH_2$ to $H_2C=CH_2$; (7) α vs β hydride abstraction in metal alkyls; (8) stereochemistry of α-hydride abstraction; (9) alkylidene to olefin rearrangements; (10) syntheses of acetylide and vinylidene ($C_2$) complexes; (11) acid/base chemistry of metal hydrides. 3 figs.

**46877** **(DOE/ER/13323—1) Mechanistic studies of carbon monoxide reduction. Progress report.** Geoffroy, G.L. (Pennsylvania State Univ., University Park (USA)). 1985. Contract FG02-85ER13323. 9p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85017707.

Mechanistic schemes for the metal surface catalyzed reduction of carbon monoxide to methanol and to hydrocarbons have been proposed, and the feasibility of these mechanisms is being tested by preparing and studying the intermediates. Initial study was on the preparation and reactivity studies of cluster complexes bearing formyl and acyl substituent groups. This progress report, briefly describes accomplishment for the following studies: (1) triosmium clusters as models for carbon monoxide reduction; (2) coupling of carbene and nitrene ligands on an $Fe_3$ cluster; (3) halide promoted insertion reactions; and (4) insertion of metals into metal-methylene bonds.

**46878** **(DOE/PC/30229—6) Thermal reactions of aromatics with CaO. Technical progress report, April 1-August 31, 1983.** Longwell, J.P.; Lai, C.K.; Williams, G.C.; Peters, W.A. (Massachusetts Inst. of Tech., Cambridge (USA)). Nov 1983. Contract FG22-80PC30229. 27p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85017254.

The pyrolysis of m-cresol and 1-methylanthracene was studied over both CaO and quartz over the temperature range of 350 to 800°C. Vapor-phase concentration of the model compound was 5 mole percent for m-cresol and 1.8 mole percent for 1-methylanthracene. The calcium oxide significantly increased the rates and extents of pyrolysis of the aromatics, reducing the temperature for a given amount of conversion by at least 120°C. A proposed mechanism for pyrolysis of m-cresol over CaO involves formation of calcium-cresol salts, which then undergo further cracking at temperatures above 500°C to yield coke, CO, $CH_4$, toluene and $C_6H_6$. Chemical condensation reactions were the predominant reactions observed in the pyrolysis of 1-methylanthracene over CaO. A comparison of the pyrolysis results of 1-methylanthracene with those of 9-methylanthracene (studied earlier) indicated that the 1-methyl isomer was slightly less reactive over both solids, and that some of the thermal reactions over CaO were also structure specific. Deactivation of CaO was studied by measuring loss of cumulative cracking activity during pyrolysis of 1-methylanthracene. The decay of CaO activity with overall utilization time (or cumulative amount of feed reacted), was well-fitted by a power-law model. Coke burnoff in $O_2$ at temperatures between 600-700°C regenerated ~80 percent of the CaO initial activity. The 20 percent loss is attributed to either formation of $CaCO_3$ from the CaO or sintering of the CaO particles during regeneration. 7 refs., 11 figs., 1 tab.

**46879** **Preparation and reactivity of an organometallic Lewis acid bearing two accessible coordination sites.** Markham, J.; Menard, K.; Cutler, A. (Rensselaer Polytechnic Institute, Troy, NY). *Inorganic Chemistry;* **24**: No. 10, 1581-1587(8 May 1985).

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Treatment of the eta$^3$-allyl complex $Cp(CO)_2Mo(CH_2CHCH_2)$ with one equivalent of $HBF_4$ generated a eta$^2$-propane compound, a covalent molecule containing ligated propene and $FBF_3^-$, and a rapidly equilibrating mixture of cis and trans isomers. Carboxylation of the eta$^2$-propane compound yielded the propane salt. The eta$^2$-propane compounds functioned as a labile precursor to the formally 14-electron (or doubly unsaturated) Lewis acid, $Cp(CO)_2Mo^+$. Both latent coordination sites on the eta$^2$-propene complex were available for selectively forming disubstituted derivatives upon treatment with $PPh_3$ and $I^-$ respectively, under mild conditions. Corresponding Lewis acid with only one coordination site yielded only the mono-substituted derivatives under comparable reaction conditions.

**46880 Deuterium-substitution effects on relaxation times and interligand nuclear Overhauser effects for assignment of ligand resonances and isomer identification in cobalt(III) complexes.** Storm, C.B.; Turner, A.H.; Rowan, N.S. (Howard Univ., Washington, DC). *Inorganic Chemistry;* **24**: No. 8, 1269-1271(10 Apr 1985).

Relaxation time, $T_1$, and nuclear Overhauser effects are reported for nine imidazole complexes and one histidine complex of Co(III). From these values unequivocal resonance and isomer assignments can be made. The deuterium substitution effect of $T_1$'s has been used to determine intranuclear distances and molecular configurations.

## 4004 Electrochemistry

*REFER ALSO TO CITATION(S) 46285, 46298, 46300, 46404, 46782, 46803*

**46881 (CONF-841121—23) Mass transport from single droplets in imposed electric fields.** Wham, R.M.; Byers, C.H. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 24p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016382.

From AIChE annual meeting; San Francisco, CA, USA (25 Nov 1984).

Electric field effects on mass transfer involving droplets in a 2-ethyl-hexanol medium are studied. Single water droplets are observed under the influence of both steady and pulsed electric fields. Droplet oscillations result in the latter case, enhancing the continuous phase mass transfer coefficient. These data are compared with results from both nonoscillating mass transfer and theoretical models. 8 refs., 8 figs.

**46882 (IVA—274) Modern electrochemical engineering.** (Royal Swedish Academy of Engineering Sciences, Stockholm). 1984. 72p. (CONF-8405344—). NTIS (US Sales Only), PC A04/MF A01. File Number DE85752519.

From Conference on modern electrochemical engineering; Stockholm, Sweden (15 May 1984).

The seminar was arranged by the working group on electrochemistry of the academy with the aim of studying and discussing future developments and applications of electrochemistry and to promote contacts between electrochemists in Sweden and foreign specialists in this field. The lectures dealt with electrocatalysis and electrochemical engineering, molten salt electrolysis and porous electrodes.

**46883 Oxidative electrochemistry of iron-selenocarbonyl porphyrins.** Gorce, J.N.; Bottomley, L.A. (Georgia Institute of Technology, Atlanta). *Inorganic Chemistry;* **24**: No. 10, 1431-1436(8 May 1985).

The oxidation of selenocarbonyl(5,10,15,20-tetraphenylporphinato)iron(II), (TPP)FeCSe, was studied in 1,2-dichloroethane solution at a Pt-button electrode. Results from detailed voltammetric and spectroelectrochemical experiments (both electronic and infrared) indicated that (TPP)FeCSe can be oxidized in two chemically reversible, one-electron transfers. This is comparable to thiocarbonyl iron porphyrin but is in marked contrast with the analogous carbonyl iron(II) porphyrin derivative. The latter complex loses CO concomitantly with the removal of the first electron. The product of the first oxidation of (TPP)FeCSe is a selenocarbonyl iron(III) porphyrin whereas the second oxidation step occurs at the periphery of the porphyrin ring, producing the selenocarbonyl iron (III) porphyrin cation radical. Addition of nitrogenous bases to solution generated the monoadduct, (TPP)FeCSe [nitrogenous base]. This adduct was also oxidized in two discrete, one-electron transfers. The product of the first oxidation, ((TPP)Fe/sup III/CSe[nitrogenous base])$^+$, was stable for hours. The product of the second oxidation, however, readily underwent nucleophilic attack by uncomplexed nitrogenous base present in solution. The electronic effects generated by the ligand trans to the selenocarbonyl moiety are discussed in the context of their influence on the spectral, electrochemical, and thermodynamic properties of the selenocarbonyl iron porphyrin.

**46884 Short protection device for stack of electrolytic cells.** Katz, M.; Schroll, C.R. (to Dept. of Energy). US Patent Application 6-676,340. 29 Nov 1984. 14p. Contract AC21-79ET15440. DE85017727 NTIS, PC A02/MF A01; GPO Dep. File Number DE85017727.

The present invention relates to a device for preventing the electrical shorting of a stack of electrolytic cells during an extended period of operation. The device has application to fuel cell and other electrolytic cell stacks operating in low or high temperature corrosive environments. It is of particular importance for use in a stack of fuel cells operating with molten metal carbonate electrolyte for the production of electric power. Also, the device may have application in similar technology involving stacks of electrolytic cells for electrolysis to decompose chemical compounds.

## 4005 Photochemistry

*REFER ALSO TO CITATION(S) 46277, 46278, 46279, 46280, 46281, 46282, 46283, 46284, 46285, 46286, 46287, 46288, 46289, 46290, 46291, 46292, 46293, 46294, 46295, 46296, 46297, 46298, 46299, 46300, 46301, 46302, 46303, 46304, 46305, 46308, 46343, 46860, 46895*

**46885 (DOE/EV/05855—8) Energy transformation in molecular electronic systems.** Kasha, M. (Florida State Univ., Tallahassee (USA)). 25 Jul 1985. Contract AS05-78EV05855. 11p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85017187.

Our new optical pumping spectroscopy (steady state, and double-laser pulse) allows the production and study of the unstable rare tautomer in its ground and excited states, including picosecond dynamic studies. Molecules under study here included 7-azaindole (model for biological purines), 3-hydroxyflavone (model for plant flavones), lumichrome, and other heterocyclics. New detailed molecular mechanisms for proton transfer are derived, especially with catalytic assisting molecules. A new proton-transfer laser of extraordinary efficiency has become a side dividend, possibly worth of industrial development. The excited and highly reactive singlet molecular oxygen species $^1\Delta$/sub g/) has proven to be ubiquitous in chemical peroxide systems and in physically excited sensitizer-oxygen systems. Hyperbaric oxygen mechanisms in biology probably involve singlet oxygen. We have undertaken a spectroscopic study of tris - dibenzoylmethane chelates of Al, Gd, Eu, and Yb trivalent ions. These chelates offer a variety of electronic behaviors, from Z-effects on $\pi$-electron spin-orbital coupling (Al, Gd) to Weissman intramolecular energy transfer to 4f mestable levels (Eu, Gd). Elegant new spectroscopic resolution at 77K permits separation of tautomeric, parasitic self-absorption, dissociation, and cage effects to be resolved. 18 refs., 4 figs.

**46886 (INIS-SU—300, pp 20-23) Mechanism of water oxidation by trivalent ruthenium trisdipyridyl complex.** Moravskij, A.P.; Khannanov, N.K.; Khramov, A.V.; Shafirovich, V.Ya. (AN SSSR, Chernogolovka. Otdelenie Inst. Khimicheskoj Fiziki). 1983. (In Russian). NTIS (US Sales Only), PC A08/MF A01. File Number DE85781600.

From 6. Soviet-French seminar on catalysis; Moscow (USSR) (1983).

Results of kinetic investigation of water oxidation reaction with photogenerated single-electron oxidizer-trisdipyridyl complex of Ru(3) are presented. $CoCl_2 \times 6H_2O$ within the concentration range of $[Co^{2+}]_0 = 5 \times 10^{-7} - 5 \times 10^{-5}$ M was used as a reaction cat-

alyst. The method of stopped flow with spectrophotometric recording was used in order to control the reaction kinetics.

46887 **(LBL—20043) Chemistry and dynamics of $NO_3$ produced by photolysis of $N_2O_5$.** Swanson, D.M. (Lawrence Berkeley Lab., CA (USA)). Jul 1985. Contract AC03-76SF00098. 132p. NTIS, PC A07/MF A01; GPO Dep. File Number DE85017657.

Thesis.

The results of several different studies involving the nitrate radical ($NO_3$) are reported in this work. The method of Flash Photolysis/Laser Absorption was used to measure directly the quantum yield for $NO_3$ production from UV photolysis of $N_2O_5$. Several product channels are possible at UV wavelengths. Although previous indirect studies indicated that the major products were 2 $NO_2$ + O, this work has shown that $NO_3$ is a primary product. The quantum yield of $NO_3$ obtained for photolysis at 249 nm was 0.90 +- 14 independent of pressure and $N_2O_5$ concentration. A fast rise in the concentration of $NO_3$ was observed which was dependent on both pressure and $N_2O_5$ concentration. The rate constants obtained for the deactivation process $NO_3(nu > 0) + M \rightarrow No_3(nu = 0) + M$ were $k(N_2O_5) = 4.0 +- 1.0 \times 10^{-12}$ $cm^3sec^{-1}$ and $k(N_2) = 1.6 +- 0.3 \times 10^{-13}$ $cm^3sec^{-1}$. The structure of $NO_3$ was investigated by ab initio calculational methods. Geometry optimization gave a $^2B_2$ ground state of C/sub 2v/ symmetry with N-O bond distances $R_1 = 1.34A$, R/sub 2,3/ = 1.18A and unique angle $\Theta = 132°$. This structure was found to be 33.6 kcal/mole lower in energy than the optimized D/sub 3h/ structure (R = 1.21A). Calculated vibrational frequencies were consistent with those recently observed experimentally. 52 refs., 31 figs., 22 tabs.

46888 **Subpicogram laser-induced fluorescence detection of aromatic hydrocarbons in vapor-deposited aromatic crystals.** Pace, C.F.; Maple, J.R. (Department of Chemistry, University of New Mexico, Albuquerque, New Mexico 87131). *Journal of the Optical Society of America B: Optical Physics;* **2**: No. 9, 1582-1588(Sep 1985).

Aromatic hydrocarbons can be detected at subpicogram levels under conditions of high spectral resolution when the sample is placed in an aromatic crystal with molecular dimensions matched to the analyte. The advantages of using a low-temperature parent-molecule matrix have been assessed by comparing the laser-induced fluorescence and two-photon excitation of fluorescence spectra of methylnaphthalene, chloronaphthalene, and hydroxynaphthalene derivatives in durene and naphthalene crystals. It has been demonstrated that the parent-molecule matrix is well suited for use with its derivatives and that sharp spectral features result for a wide variety of substituents and substitution positions. The vapor-deposition procedure that has been developed is characterized by high spectral resolution and good quantitative precision and is often essential for detecting subpicogram levels. The potential of two-photon excitation of fluorescence for trace analysis has also been explored.

46889 **Complex chemistry of reactive organic compounds. 48.[1] $\sigma$-alkyl, $\pi$-allyl, and $\pi$-olefin coordination of diphenylketene: neutron diffraction studies of the carbonyliron complexes $Fe(CO)_3[eta^3:eta^1 - (C_6H_5)_2CCO]$ and $Fe_2(CO)_6[CH(C_6H_5)(C_6H_4)]$.** Bkouche-Waksman, I.; Ricci, J.S. Jr.; Koetzle, T.F.; Weichmann, J.; Herrmann, W.A. (Brookhaven National Lab., Upton, NY). *Inorganic Chemistry;* **24**: No. 10, 1492-1499(8 May 1985). Contract AC02-76CH00016.

Photolysis of pentacarbonyl iron in the presence of diphenylketene yields a novel $eta^1.eta^3$ diphenylketene complex. This compound according to a single-crystal neutron diffraction study, exhibits the heterocumulene precursor in a $\pi$-allyl/$\sigma$-acyl coordination with one phenyl ring engaged in $\pi$ bonding of this ligand to the transition-metal center. Upon treatment of the diphenylketene with excess enneacarbonyldiiron, a dinuclear iron complex is formed in a 77% yield. This molecule was shown by neutron diffraction techniques to contain a bridging hydrocarbon ligand related to the original ketene ligand in the original iron complex by decarbonylation and 1,3-hydrogen shift. Crystallographic data are presented for both the complexes.

## 4006 Radiation Chemistry

*REFER ALSO TO CITATION(S) 46705*

46890 **(DOE/EV/02364—21) Mechanisms for radiation damage in DNA. Progress report.** Sevilla, M.D. (Oakland Univ., Rochester, MI (USA)). Jul 1985. Contract AC02-76EV02364. 15p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85017473.

In this project we have proposed several mechanisms for radiation damage to DNA and its constituents, and have detailed a series of experiments utilizing electron spin resonance spectrometry to test the proposed mechanisms. In the past we have concentrated chiefly on investigating irradiated systems of DNA constituent. In this past year's effort we have concentrated on radiation effects on DNA itself. In addition studies of radiation effects on lipids and model compounds have been performed which will shed light on the only other proposed site for cell kill, the membrane. 8 refs., 4 figs.

46891 **(DOE/EV/02364—22) Mechanisms for radiation damage in DNA.** Sevilla, M.D. (Oakland Univ., Rochester, MI (USA)). Jul 1985. Contract AC02-76EV02364. 17p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85017476.

Radiation damage to DNA results from the direct interaction of radiation with DNA where positive ions, electrons and excited states are formed in the DNA, and the indirect effect where radical species formed in the surrounding medium by the radiation attack the DNA. The primary mechanism proposed for radiation damage, by the direct effect, is that positive and negative ions formed within the DNA strand migrate through the stacked DNA bases. The ions can then recombine, react with the DNA bases most likely to react by protonation of the anion and deprotonation or hydroxylation of the cation or transfer out of the DNA chain to the surrounding histone protein. This work as aimed at understanding the possible reactions of the DNA base ion radicals, as well as their initial distribution in the DNA strand. 31 refs.

46892 (INIS-mf—9743, pp 19-21) **Interaction of ionizing radiation with proteins and their basic components.** Kopoldova, J. (Ceskoslovenska Akademie Ved, Prague. Ustav Nuklearni Biologie a Radiochemie). 1984. (In Czech). NTIS (US Sales Only), PC A04/MF A01. File Number DE85781606. (CONF-8411173—).

From Seminar on application of ionizing radiation in foods and feeds treatment; Prague, Czechoslovakia (28 Nov 1984).

Radiation and chemical changes in amino acids, peptides and proteins depend on irradiation conditions, i.e., whether they are irradiated in solid state and a chemically pure form or in solution in the presence of other substances. The effect of these conditions on the formation and concentration of radicals during irradiation is discussed. Owing to great differences in the structure of the protein molecule the proteins have diverse sensitivity to ionizing radiation. This is illustrated by the table of relative values of radiosensitivity of enzymes irradiated in aqueous solutions. Proteins in foodstuffs are not as sensitive to radiation as chemically pure proteins in aqueous solutions. The irradiation dose 70 kGy did not affect the composition of amino acids in the proteins of rat diet. (E.F.).

46893 (INIS-mf—9743, pp 22-24) **Radiolysis of saccharides.** Bludovsky, R. (Vyzkumny Ustav Potravinarskeho Prumyslu, Prague (Czechoslovakia)). 1984. (In Czech). NTIS (US Sales Only), PC A04/MF A01. File Number DE85781606. (CONF-8411173—).

From Seminar on application of ionizing radiation in foods and feeds treatment; Prague, Czechoslovakia (28 Nov 1984).

Radiolysis of saccharides proceeds differently for crystalline saccharides and for saccharides in solution. In crystals, the crystal lattice where energy transfer takes place affects the yields of radiolytic products. During irradiation of aqueous solutions of saccharides with ionizing radiation the direct effect is replaced by the effect of the products of water radiolysis mainly by the OH radical. The mechanism of the three basic reaction paths of this radical is described together with the resulting reaction products. The result

of the chemical analysis of radiolytic products of starch and cellulose are given, formic acid is the main component. Radiation also changes physical properties of saccharides, i.e., viscosity, optical rotation, melting point, etc. Radiation treatment of foodstuffs and feeds with the doses applied does not cause toxicity. (E.E.).

46894 **Thermally stimulated luminescence of UV- and X-irradiated caffeine.** Jahan, M.S. (Memphis State Univ., TN (USA)); Cooke, D.W. (Los Alamos National Lab., NM (USA)). *Photochemistry and Photobiology;* **41**: No. 3, 343-349(Mar 1985).

Thermally stimulated luminescence studies of UV- (254 nm) and X-irradiated caffeine have been conducted in the interval 77-300 K. The X-ray-induced glow curve exhibits peaks at 102, 128, 158, and 198 K, whereas the UV-induced curve is characterized by peaks with maxima at 120 and 208 K. Analysis of the X-ray-induced glow peaks revealed that the 102 and 128 K peaks obeyed first-order kinetics, while the 158 and 198 K ones followed orders of 1.3 and 1.8, respectively. Trapping parameters associated with the peaks were also elucidated. Concomitant emission spectra of each glow peak (both UV and X-ray induced) were identical and consisted of a band with well-defined maxima at 405 and 480 nm which are attributed to singlet ($S_1 \rightarrow S_0 + h\nu$) and triplet ($T_1 \rightarrow S_0 + h\nu$) transitions, respectively. At elevated temperatures the triplet transition is not observed due to quenching of the triplet state or to triplet-triplet interactions. An energy-level diagram depicting the thermally stimulated processes in irradiated caffeine is presented.

46895 **Time-sequenced pulse radiolysis laser photolysis spectroscopy. Application to water-soluble porphyrins.** Levanon, H.; Gonen, O. (Univ. of Notre Dame, IN). *Chemical Physics Letters;* **104**: No. 4, 363-368(10 Feb 1984).

Experiments employing the time-sequenced pulsed radiolysis laser photolysis on zinc(II)-tetra-(N-methyl-4-pyridyl)porphyrin chloride (P) in aqueous solutions are presented. This setup enables photoexcitation of the system before, during, and after the transient radical formation. Two types of reactions are treated: (1) the reactivity of photoexcited triplet, P/sup T/, as compared to its ground state, P, with i-PrOH and $Br_2^-$ radicals in redox reactions; (2) the dynamic and kinetic effects of photoexcitation on the porphyrins ground state radical ($P^+$ or $P^-$) system.

## 4007 Radiochemistry And Nuclear Chemistry

*REFER ALSO TO CITATION(S) 46189*

46896 **(LA—10461-MS) Leaching behavior of particulate plutonium oxide.** Kosiewicz, S.T.; Heaton, R.C. (Los Alamos National Lab., NM (USA)). Aug 1985. Contract W-7405-ENG-36. 10p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85017947.

Different size cuts of $^{238}PuO_2$ particles were mixed with deionized water at two temperatures in a shaker bath. The gross plutonium concentration in the water was measured, as well as that portion of the plutonium retained on a 0.1-μm pore filter. The concentration of the plutonium released was primarily a function of the surface area of the particles. The release rate of plutonium into the water for the size cut with particles having diameters between 30 and 20 μm was 3 ng/m²/s; this rate is within the range observed in past experiments involving aquatic environments. The amount of material retained by the 0.1-μm filters decreased with increasing time, suggesting that size reduction or removal processes occurred. 6 refs., 3 figs., 9 tabs.

46897 **(LA-UR—85-3111) Formation of plutonium(IV) colloid by the alpha-reduction of aqueous solutions of Pu(V) and Pu(VI).** Hobart, D.E.; Newton, T.W.; Palmer, P.D. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 10p. (CONF-8509147—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85017524.

From ACTINIDES '85; Aix-en-Provence, France (1 Sep 1985).

We describe concentration changes caused by chemical and alpha-induced radiolytic reactions in various oxidation state pure solutions of Pu(VI), Pu(V), or Pu(IV) colloid or mixtures of these oxidation states at pH values > 1 for a period of nearly two years. The rates of approach to steady-states and the resulting experimental concentration quotient values were determined in order to find the conditions under which equilibrium in $2PuO_2^+ + PuO_2^{2+} +$ PuO/sub 2(coll)/ reaction might be attained and to learn about the underlying reactions. Computer calculations were used to compare the data with the results required from proposed reaction schemes.

46898 **(LA-UR—85-3112) Chemistry of berkelium: a review.** Hobart, D.E.; Peterson, J.R. (Los Alamos National Lab., NM (USA); Tennessee Univ., Knoxville (USA). Dept. of Chemistry; Oak Ridge National Lab., TN (USA)). 1985. Contract AS05-76ER04447;AC05-84OR21400;W-7405-ENG-36. 5p. (CONF-8509147—2). NTIS, PC A02/MF A01; GPO Dep. File Number DE85017523.

From ACTINIDES '85; Aix-en-Provence, France (1 Sep 1985).

Element 97 was first produced in December 1949, by the bombardment of americium-241 with accelerated alpha particles. This new element was named berkelium (Bk) after Berkeley, California, the city of its discovery [Thompson, Ghiorso, and Seaborg, Phys. Rev. 77, 838 (1950); 80, 781 (1950)]. In the 36 years since the discovery of Bk, a substantial amount of knowledge concerning the physicochemical properties of this relatively scarce transplutonium element has been acquired. All of the Bk isotopes of mass numbers 240 and 242 through 251 are presently known, but only berkelium-249 ($\beta^-$ decay, 0.125 MeV, t/sub 1/2/ = 325 days) is available in sufficient quantities for bulk chemical studies. About 0.7 gram of this isotope has been isolated at the HFIR/TRU Complex in Oak Ridge, Tennessee in the last 18 years. Over the same time period, the scale of experimental work using berkelium-249 has increased from the tracer level to bulk studies at the microgram level to solution and solid state investigations with milligram quantities. Extended knowledge of the physicochemical behavior of berkelium is important in its own right, because Bk is the first member of the second half of the actinide series. In addition, such information should enable more accurate extrapolations to the predicted behavior of heavier elements for which experimental studies are severely limited by lack of material and/or by intense radioactivity.

46899 **(LBL—20031) Preparations and mechanism of hydrolysis of ([8]annulene)actinide compounds.** Moore, R.M. Jr. (Lawrence Berkeley Lab., CA (USA)). Jul 1985. Contract AC03-76SF00098. 161p. NTIS, PC A08/MF A01; 1; GPO Dep. File Number DE85017656.

The mechanism of hydrolysis for bis[8]annulene actinide and lanthanide complexes has been studied in detail. The uranium complex, uranocene, decomposes with good pseudo-first order kinetics (in uranocene) in 1 M degassed solutions of $H_2O$ in THF. Decomposition of a series of aryl-substituted uranocenes demonstrates that the hydrolysis rate is dependent on the electronic nature of the substituent (Hammett rho value = 2.1, $r^2$ = 0.999), with electron-withdrawing groups increasing the rate. When $D_2O$ is substituted for $H_2O$, kinetic isotope effects of 8 to 14 are found for a variety of substituted uranocenes. These results suggest a pre-equilibrium involving approach of a water molecule to the central metal, followed by rate determining proton transfer to the eight membered ring and rapid decomposition to products. Each of the four protonations of the complex has a significant isotope effect. The product ratio of cyclooctatriene isomers formed in the hydrolysis varies, depending on the central metal of the complex. However, the general mechanism of hydrolysis, established for uranocene, can be extended to the hydrolysis and alcoholysis of all the [8]annulene complexes of the lanthanides and actinides.

46900 **(RISO-M—2473) Weathering and decontamination of radioactivity deposited on concrete surfaces.** Warming, L. (Risoe National Lab., Roskilde (Denmark)). Dec 1984. 13p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85702149.

Long lived fission products might be deposited in the environment after a serious reactor accident. At Risoe we have studied how Danish weather conditions and fire hosing influence the decontamination of Rubidium86 (representing Cesium134 and Cesium137) deposited on concrete surfaces. Measurements have

been made at two different types of concrete and at some asphalt surfaces for comparison.

**46901 (SSI-A—84-10) Radon in housing.** (National Inst. of Radiation Protection, Stockholm (Sweden)). Apr 1984. 40p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85702150.

With comments on the report provided by the National Institute of Radiation Protection.

The enclosed material deals with the substantial efforts made until now to control the levels of radon in Sweden dwellings. It is meant as a source material for the several publications which have emerged from the National Institute of Radiation Protection in Stockholm during 1983 and 1984. The first document is a translation of chapter 16, the deliberations of the Swedish Radon Commission, appointed by the government in 1979. Comments on the report of the commission were solicited before 1 October, 1983.

**46902 Compounds which mediate Gallium-67 transfer from lactoferrin to ferritin.** Weiner, R.E.; Schreiber, G.J.; Hoffer, P.B.; Bushberg, J.T. (Univ. of Kansas School of Health Sciences and Hospital, Kansas City). *Journal of Nuclear Medicine;* **26**: No. 8, 908-916(Aug 1985). Contract AC02-78EV04625.

The influence of various low molecular weight compounds on the transfer of $^{67}$Ga from human lactoferrin (LF) to horse spleen ferritin (HoFE) has been examined in vitro. When LF/sup */$^{67}$Ga complex was placed in competition with HoFE using a dialysis system the initial transfer rate (TR) of $^{67}$Ga to HoFE was slow and continuous. In the presence of 1 mM pyrophosphate (PP/sub i/) ascorbate and adenosine triphosphate (ATP), the TR was dramatically enhanced. This effect was concentration sensitive since reduction of the ATP to 0.1 mM eliminated the enhancement. Although PP/sub i/ and ascorbate ions yielded larger TR's, ATP was more effective in the promotion of $^{67}$Ga transfer to HoFE. When the LF/HoFE concentration ratio was decreased, in the presence of ATP, the transfer of $^{67}$Ga was significantly increased. These results suggest that ferritin present intracellularly could remove and retain $^{67}$Ga entering the cell in the form of a LF/sub */$^{67}$Ga complex. Moreover, increased synthesis of ferritin and cytosolic phosphate compounds would appear to enhance this process.

**46903 Chemical thermodynamic representation of <UOsub(2 +- x)>.** Lindemer, T.B.; Besmann, T.M. (Oak Ridge National Lab., TN (USA). Chemical Technology Div.). *Journal of Nuclear Materials;* **130**: 473-488(Feb 1985). (CONF-840807—). Contract AC05-84OR21400.

From Conference on chemical thermodynamics and 39. calorimetry conference; Hamilton, Canada (13 Aug 1984).

The entire <UOsub(2 +- x)>sup(**) data base for the dependence of the nonstoichiometry, x, on temperature and chemical potential of oxygen (oxygen potential) was retrieved from the literature and represented. This data base was interpreted by least-squares analysis using equations derived from the classical thermodynamic theory for the solid solution of a solute in a solvent. For hyperstoichiometric oxide at oxygen potentials more positive than -266700 + 16.5T J/mol, the data were best represented by a [$UO_2$]-[$U_2$Osub(4.5)] solution. For O/U ratios above 2 and oxygen potentials below this boundary, a [$UO_2$]-[$U_2$Osub(4.5)] solution represented the data. The <UOsub(2 - x)> data were represented by a [$UO_2$]-[Usub(1/3)] solution. The resulting equations represent the experimental ln($PO_2$sup(*))-ln(x) behavior and can be used in thermodynamic calculations to predict phase boundary compositions consistent with the literature. Collectively, the present analysis permits, for the first time, a mathematical representation of the behavior of the total data base.

**46904 Isotopic generator for bismuth-212 and lead-212 based on radium.** Hines, J.J.; Atcher, R.W.; Friedman, A.M. (to Dept. of Energy). US Patent Application 6-696,547. 30 Jan 1985. 30p. Contract W-31-109-ENG-38. DE85017786 NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85017786.

Disclosed are method and apparatus for providing radionuclides of bismuth-212 and lead-212. Thorium-228 and carrier solution starting material is input to a radiologically contained portion of an isotopic generator system, and radium-224 is separated from thorium-228 which is retained by a strongly basic anion exchange column. The separated radium-224 is transferred to an accessible, strongly acidic cationic exchange column. The cationic column retains the radium-224, and natural radioactive decay generates bismuth-212 and lead-212. The cationic exchange column can also be separated from the contained portion of the system and utilized without the extraordinary safety measures necessary in the contained portion. Furthermore, the cationic exchange column provides over a relatively long time period the short lived lead-212 and bismuth-212 radionuclides which are useful for a variety of medical therapies.

## 4008 Combustion, Pyrolysis, And High-temperature Chemistry

*REFER ALSO TO CITATION(S) 46787, 46986*

**46905 (DOE/CS/40521—T1) Evaluation of industrial combustion control systems. Final report.** Presser, C.; Semerjian, H.G. (National Bureau of Standards, Washington, DC (USA). Center for Chemical Engineering). Oct 1984. Contract AT01-81CS40521. 254p. NTIS, PC A12/MF A01; 1; GPO Dep. File Number DE85016803.

This study evaluated $O_2$ and CO monitoring systems used for combustion controls to provide reliable data on their performance, operating range and accuracy. The study concentrated on three in-situ $O_2$ and two in-situ CO monitoring systems which are applicable to furnace and boiler controls. The project provides technical information for cost/benefit analysis of combustion control systems and to help expedite implementation of combustion control technology by industry. The evaluation of the stack gas monitoring systems was carried out for ranges of furnace operating parameters such as fuel to air mixture ratio, burner firing rate, heat extraction rate, fuel type, combustion air preheat temperature, and cyclic operating conditions, which are based on information gathered from typical operational practices of representative industrial furnaces and boilers. The experiments were performed in the NBS experimental furnace under both natural gas and No. 2 fuel oil fired conditions. An on-line gas sampling/analysis system was used as a reference system for comparative evaluation of the stack gas monitors. The system is set up to determine the level of CO, $CO_2$, $O_2$, NO/NO/sub x/ and total hydrocarbons in the stack gases.

**46906 (DOE/ID/12424—T1) Increasing efficiency of multiple burner boilers.** Cooper, M.H. (Bailey Controls Co., Wickliffe, OH (USA)). Mar 1985. Contract FC07-82ID12424. 86p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE85017465.

The feasibility of using analysis of stratified flue gas as a guide to more precise adjustment of burners, thereby increasing fuel efficiency of multiple burner combustion equipment was demonstrated. To establish a reference data base, the excess oxygen content in flue gas was determined at many points in the duct at the exit from the combustion chamber. A brief change to fuel-air ratio was then made at a single burner, and the variation in oxygen caused by this perturbation was recorded at selected duct locations. Individual data were obtained on all burner-to-duct area combinations. In practically all cases the change was more pronounced in a particular area. The duct region most affected can be repeatedly and predictably related to the burner changes. The results obtained provide positive evidence that multiple point analysis of flue gases can be an effective guide in achieving improved efficiency by more precise adjustment of individual burners. A multiple sample analyzer was designed and tested to further illuminate the stratification phenomena.

**46907 (LA-UR—85-2332) Using computers to answer fundamental questions in combustion theory: an example from droplet combustion.** Janssen, R.D.; O'Rourke, P.J. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 20p. (CONF-8506169—2). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85015681.

From 17. AMS-SIAM summer seminar in applied mathematics; Ithaca, NY, USA (30 Jun 1985).

Many fundamental questions in combustion theory are either partially or totally intractable analytically. Thus, it is often desirable to use computed results to supplement information obtained by analytic means. We illustrate how computation can supplement analysis by examining the role of gas-phase unsteadiness in droplet vaporization and combustion. 9 refs., 4 figs., 2 tabs.

46908 **(PB—85-219632/XAB) Effects of chemistry and swirl on the production of turbulence in a flame. Annual report, December 1983-November 1984.** Driscoll, J.F. (Michigan Univ., Ann Arbor (USA). Dept. of Aerospace Engineering). Mar 1985. 29p. NTIS, PC A03/MF A01.

The goal of this project is to measure the gas velocity, temperature, and turbulence levels within a swirl-stabilized flame while independently varying the swirl number and the air-fuel ratio. The measurements are used to identify how much turbulence and recirculation are needed to obtain a stable flame of a desired length; results are also used to improve current computer models of turbulent combustion so that they can better handle swirl and thus be more useful for the design of practical burners. The measurements are used to assess several computer models. Laser velocimetry and laser Rayleigh scattering diagnostics are used. Quantities to be measured in the future using Rayleigh scattering include the local temperature, temperature fluctuations, temperature gradients, the local turbulent heat flux, i.e., the velocity-temperature correlation, and the heat-release pattern.

46909 **Coherent interference in multiplex CARS measurements: nonresonant susceptibility enhancement due to laser breakdown.** Beiting, E.J. (Mississippi State University, Physics Department & MHD Energy Center, Mississippi State, Mississippi 39762). *Applied Optics;* **24**: No. 18, 3010-3017(15 Sep 1985). Contract AC02-80ET15601.

A coherent interference with multiplex CARS signals is observed. This effect appears when coal fly ash particles are injected into the combustion flow being probed. The interference has the same spectral characteristics of the Stokes broadband dye laser shifted to anti-Stokes frequencies and is correlated with weak particle-induced laser breakdown. Analysis indicates the phenomenon is due to the enhancement of the nonresonant susceptibility in the small volume of the discharge plasma.

46910 **Optical emission line monitor with background observation and cancellation.** Goff, D.R.; Notestein, J.E. (to Dept. of Energy). US Patent Application 6-688,670. 4 Jan 1985. 15p. DE85017745 NTIS, PC A02/MF A01; GPO Dep. File Number DE85017745.

A fiber optics based optical emission line monitoring system is provided in which selected spectral emission lines, such as the sodium D-line emission in coal combustion, may be detected in the presence of interferring background or blackbody radiation with emissions much greater in intensity than that of the emission line being detected. A bifurcated fiber optic light guide is adapted at the end of one branch to view the combustion light which is guided to a first bandpass filter, adapted to the common trunk end of the fiber. A portion of the light is reflected back through the common trunk portion of the fiber to a second bandpass filter adapted to the end of the other branch of the fiber. The first filter bandpass is centered at a wavelength corresponding to the emission line to be detected with a bandwidth of about three nanometers (nm). The second filter is centered at the same wavelength but having a width of about 10 nm. First and second light detectors are located to view the light passing through the first and second filters respectively. Thus, the second detector is blind to the light corresponding to the emission line of interest detected by the first detector and the difference between the two detector outputs is uniquely indicative of the intensity of only the combustion flame emission of interest. This instrument can reduce the effects of interfering blackbody radiation by greater than 20 dB.

# 42 ENGINEERING

## 4201 General Engineering

46911 **(EGG-M—11685) Eigenstructure view of cascade control.** Griffith, J.M.; Bannister, D.G.; Venhuizen, J.R. (EG and G Idaho, Inc., Idaho Falls (USA)). 1985. Contract AC07-76ID01570. 13p. (CONF-851045—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85014582.

From Instrument Society of America international conference and exhibit; Philadelphia, PA, USA (21 Oct 1985).

Cascade control is one of the early and widely successful multi-input control techniques used in the process industry. The technique essentially consists of nesting a secondary control loop inside a primary control loop and considering the primary controller to produce a setpoint for the secondary controller. When will cascade control be effective. Success is generally thought directly related to the ratio of time constants in the two loops. A fast secondary loop and slow primary loop indicates high probability of success. An eigenstructure analysis of the cascade configuration reveals that the major benefits of cascade control actually occur in the presence of slow secondary loops. The eigenstructure control strategy provides a straightforward procedure for calculating controller gains with the cascade configuration and other more general multi-input, multi-output configurations.

46912 **(EUR—9534-EN) Passive solar test facility.** Baker, N.V. (Commission of the European Communities, Luxembourg. Directorate-General for Information, Market and Innovation). 1984. 105p. Commission of the European Communities, Luxembourg. Office of Official Publications of the European Communities.

This study is intended as a precursor to a project providing a physical test facility. Section 1 is an executive summary, giving the most important points from the study including recommendations for a Pilot Test Cell scheme. Section 2 is concerned with contextural material - the role of physical testing and the need for further facilities at a European scale. Section 3 the physical/thermal processes which have particular relevance to the performance of passive solar buildings are examined. Section 4 firstly a distinction is drawn between two streams of work - that which is carried out using simplified boundary conditions, and that which requires realistic (and usually outdoor) conditions. Section 5 concentrates upon the principles of establishing a realistic test environment for the outdoor cell. Section 6 discusses the way in which the performance of the component or system will be assessed. Section 7 incorporating the principles established in earlier chapter, an outline design is produced.

46913 **(UCID—30200-83-7) VIBMAIN: one-dimensional vibration.** Calder, C. (Lawrence Livermore National Lab., CA (USA)). 1 Jul 1985. Contract W-7405-ENG-48. 47p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85017396.

A first engineering course in vibration is traditionally taught at the senior level and deals with the theory and concepts of a one-dimensional vibration system. Course content begins with free vibration of undamped and viscously damped systems. Coulomb-type (friction) damping is typically given only a cursory treatment because of the difficulty inherent in the discontinuous, passive friction force. Applied forcing functions are studied next beginning with harmonic functions followed by transient force inputs. In the study of transient forces, various numerical methods are typically introduced. The purpose of the code described here is to provide a numerical of solving all of the one-dimensional problems normally encountered in a vibrations course. This includes the classical problems which can be solved in closed-form but is especially directed at solutions for problems which might contain Coulomb damping, nonlinear springs, a general forcing function, and/or base-excitation input. The code also serves to introduce the user to the power on numerical techniques and microcomputers in computer-aided engineering. The graphical output gives a clear picture of the dynamic response and illustrates the mathematical relationship between displacement, velocity, and acceleration.

**46914 (UCID—30200-83-12) MOHR: two-dimensional stress calculation and display.** Hickman, R.S. (California Univ., Santa Barbara (USA)). 1 Jul 1985. Contract W-7405-ENG-48. 60p. NTIS (US Sales Only), PC A04/MF A01; GPO Dep. File Number DE85017859.

MOHR accepts the values of stress on a two-dimensional element and draws Mohr's Circle for the two-dimensional stress problem. After drawing Mohr's Circle, the user can display the principal stress element, the maximum shear stress element, and an element at an arbitrary angle. MOHR prompts the user to input the normal stress in the x-direction, the normal stress in the y-direction, and the shear stress. These stresses are then drawn on the element in their proper orientation and the user is offered the opportunity to change the stress values. After obtaining the correct values of stress, MOHR draws Mohr's Circle. It also checks the location of the center of Mohr's Circle and whether or not the tau-axis intersects the circle. If it does, the circle is located in the center of the screen and the vertical tau-axis is drawn to the proper scale. If the circle does not intersect the vertical axis, it is drawn to the right of the screen if all stresses are negative. MOHR rejects all zeros for input. If the normal stresses are equal and the shear stress is zero, the circle collapses to a point. After the circle and the axes are drawn, a menu is offered and the user can choose to view the principal stress element, the maximum shear stress element, or an element at an arbitrary angle. The user can also choose to return for a new case or end the session. After the user selects the principal stress, maximum shear, or arbitrary element, MOHR indicates the appropriate angle on Mohr's Circle that corresponds to that which has been selected and then draws the element. The user can opt to end, return for a new case, or redraw Mohr's Circle. This program adds variable CHKFLG to the MCIO subroutine. CHKFLG is used to determine the number of times that a wrong response is entered by the user. This information is used to reset the graphics for Mohr's Circle to insure proper location of the graphics.

**46915 (WAPD-T—2869) TRANSL: a subroutine library for PATRAN-G translators.** Butler, K.M. (Bettis Atomic Power Lab., West Mifflin, PA (USA)). 1985. Contract AC11-76PN00014. 13p. (CONF-8510149—3). NTIS, PC A02. File Number DE85017634.

From Westinghouse engineering computer applications symposium; Monroeville, PA, USA (7 Oct 1985).

This paper describes the capabilities of the TRANSL subroutine library. This library streamlines the development of interface programs which translate finite element engineering models developed using PATRAN-G interactive graphics software to engineering analysis computer programs, typically executed on large mainframe computers. PATRAN-G is a powerful graphics program which greatly simplifies the tasks of generating two- or three-dimensional geometry models, creating finite element grids, and applying boundary condition. In order to convert a PATRAN-G model into a usable input deck for an engineering analysis program, a translator program must be available. Since each analysis program requires its own translator, this becomes a formidable programming task for an organization with many programs developed in-house. TRANSL is a versatile FORTRAN 77 subroutine library which has been written on the VAX 11/78X computer to perform activities which are common to any PATRAN G translator, such as data storage and manipulation, file handling, and interactive communication with the user. This library has been found to greatly reduce the development time of translators. An example of a translator written for the fluid dynamics program FIDAP is presented in this paper.

## 4202 Facilities And Equipment

*REFER ALSO TO CITATION(S) 46205, 46577, 47005, 47952, 47993*

**46916 (BDX—613-3317) Robotic deburring: a bibliography.** Gillespie, L.K. (Allied Corp., Kansas City, MO (USA). Bendix Kansas City Div.). Jul 1985. Contract AC04-76DP00613. 19p. (CONF-8509132—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85015760.

From Deburring and surface conditioning conference; Chicago, IL, USA (26 Sep 1985).

**46917 (EGG—10282-1087) Applications of fiber optic couplers to diagnostic experiments at the Nevada Test Site.** Whitcomb, B.M.; Smiley, V.N.; Flurer, R.F.; Colburn, C.W. (EG and G Energy Measurements, Inc., Las Vegas, NV (USA)). 1985. Contract AC08-83NV10282. 15p. (CONF-8508102—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85016787.

From Conference on fiber optic couplers, connectors, and splice technology II; San Diego, CA, USA (18 Aug 1985).

Fused biconical tapered (FBT) fiber optics star couplers have been used in a variety of applications at the Nevada Test Site to provide increased signal dynamic range for recording devices. Problems which were observed resulted primarily from the modal selection processes which occur in FBT couplers. This paper describes the results of work performed to characterize a new type of splitter for the same applications. The new splitters, obtained commercially, were manufactured using reflection techniques rather than the FBT approach. The splitters exhibit virtually none of the modal problems inherent in the FBT couplers.

**46918 (FNAL-TM—1334) Testing of the superconducting solenoid for the Fermilab collider detector.** Fast, R.W.; Holmes, C.N.; Kephart, R.D.; Stoffel, J.B.; Stone, M.E.; Wands, R.H.; Zimmerman, T.N.; Kondo, K.; Mori, S.; Yoshizaki, R. (Fermi National Accelerator Lab., Batavia, IL (USA); Tsukuba Univ., Sakura, Ibaraki (Japan); Hitachi Ltd., Ibaraki (Japan). Hitachi Works). Jul 1985. Contract AC02-76CH03000. 11p. (CONF-8509134—1). NTIS, PC A02. File Number DE85016987.

From Cryogenic engineering conference; Cambridge, MA, USA (13 Sep 1985).

The 3 m phi x 5 m long x 1.5 T superconducting solenoid for the Fermilab Collider Detector has been installed at Fermilab and was tested in early 1985 with a dedicated refrigeration system. The refrigerator and 5.6-Mg magnet cold mass were cooled to 5 K in 210 hours. After testing at low currents, the magnet was charged to the design current of 5 kA in 5-MJ steps. During a 390 A/min charge a spontaneous quench occurred at 4.5 kA due to insufficient liquid helium flow. Three other quenches occurred during "slow" discharges which were nevertheless fast enough to cause high eddy current heating in the outer support cylinder. Quench behavior is well understood and the magnet is now quite reliable.

**46919 (INIS-mf—9652, pp 123) Cryo target system for tritium activities up to 90 kCi.** Zmeskal, J. (Oesterreichische Akademie der Wissenschaften, Vienna); Sherman, R.H. (Los Alamos National Lab., NM (USA)). 1984. (In German). NTIS (US Sales Only), PC A07/MF A01. File Number DE85781476. (CONF-8409235—Summ.).

From Annual meeting of the Austrian Physical Society; Leoben, Austria (24 Sep 1984).

Published in summary form only.

**46920 (INIS-SU—299, pp 349-350) Geological environment of the Oklo natural fission reactors, district of Mounana, Gabon.** Gauthier-Lafaye, F.; Weber, F. (Centre National de la Recherche Scientifique, 67 - Strasbourg (France). Centre de Sedimentologie et Geochimie de la Surface). 1984. NTIS (US Sales Only), PC A17/MF A01. File Number DE85781599. (CONF-840820—Vol.9-Pt.1-Summs.).

From 27. international geological congress; Moscow, USSR (4 Aug 1984).

Short note.

**46921 (K—2056) Effects of fire exposure on integrity of $UF_6$ shipping cylinders.** Barlow, C.R.; Ziehlke, K.T.; Pryor, W.A. (Martin Marietta Energy Systems, Oak Ridge, TN (USA)). 17 Jun 1985. Contract AC05-84OT21400. 34p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85017073.

CAPE-323, available from Office of Scientific and Technical Information, P.O. Box 62, Oak Ridge, TN 37830.

Two 2-1/2-ton steel cylinders for the transport of uranium hexafluoride within the United States nuclear fuel enrichment cycle were involved in a warehouse fire where portions of the cylinders were estimated to have reached a temperature of 1600°F (870°C).

The cylinders were empty at the time of the fire and therefore were not in protective overpacks in which full product cylinders are handled while in transit. Hydrostatic tests to failure showed that the integrity of the cylinders was not degraded by exposure to the temperatures generated by the fire. They withstood test pressures in excess of 10 times the design pressure, and showed a volume expansion of 30% above the original capacity before rupture in a completely ductile fashion. Reference CAPE-323. 9 figs.

**46922 (K/D—5645) Computer-aided engineering vertical integration: a user's perspective.** Domm, T.C.; Blackerby, J.; Byington, G.A.; Chipley, K.K.; Gray, W.H.; Kuban, D.P.; Vandergriff, D.H.; Williamson, D.H. (Martin Marietta Energy Systems, Oak Ridge, TN (USA)). Aug 1985. Contract AC05-84OT21400. 91p. NTIS, PC A05/MF A01; GPO Dep. File Number DE85017244.

Vertical integration is defined as the linking of sequential computer-aided engineering (CAE) functions by means of a common data base, creating a design process that spans a spectrum of CAE activities. The need for vertical integration is established, and the existing software and hardware environment available to Engineering is examined. Vertical integration between the various CAE functions is demonstrated, and the process, capabilities, and limitations are described. Data from this report were presented at the Symposium on Integration in Computer Aided Engineering and Manufacturing Systems on March 7, 1985. Copies of the presentation view graphs are included as Appendix A.

**46923 (SAND—85-0867) Bulkhead Interface Chassis for optical fiber patching.** George, M. (Sandia National Labs., Albuquerque, NM (USA)). Jun 1985. Contract AC04-76DP00789. 24p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85017320.

An optical fiber patch panel was designed to meet the changing needs of optical fiber communication link installations. This paper deals with the specification and construction details of the Bulkhead Interface Chassis patch panel. Included is ordering information for the commercial parts needed and shop drawings of the pieces to be machined.

**46924 (SAND—85-1359C) Truck cask design for shipping Defense High Level Waste.** Madsen, M.M.; Zimmer, A. (Sandia National Labs., Albuquerque, NM (USA); GA Technologies, Inc., San Diego, CA (USA)). 1985. Contract AC04-76DP00789. 9p. (CONF-850918—7). NTIS, PC A02/MF A01; GPO Dep. File Number DE85017370.

From International topical meeting on high level nuclear waste disposal - technology and engineering; Pasco, WA, USA (24 Sep 1985).

The Defense High Level Waste (DHLW) cask is a Type B packaging currently under development by the US Department of Energy (DOE). This truck cask has been designed to initially transport borosilicate glass waste from the Defense Waste Processing Facility (DWPF) to the Waste Isolation Pilot Plant (WIPP). Specific program activities include designing, testing, certifying, and fabricating a prototype legal-weight truck cask system. The design includes such state-of-the-art features as integral impact limiters and remote handling features. A replaceable shielding liner provides the flexibility for shipping a wide range of waste types and activity levels. 5 refs., 6 figs.

**46925 (UCID—20439-Rev.1) Numerical modeling of subsurface communication. Revision 1.** Burke, G.J.; Dease, C.G.; Didwall, E.M.; Lytle, R.J. (Lawrence Livermore National Lab., CA (USA)). Aug 1985. Contract W-7405-ENG-48. 42p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85017324.

Techniques are described for numerical modeling of through-the-earth communication. The basic problem considered is evaluation of the field at a surface or airborne station due to an antenna buried in the earth. Equations are given for the field of a point source in a homogeneous or stratified earth. These expressions involve infinite integrals over wave number, sometimes known as Sommerfeld integrals. Numerical techniques used for evaluating these integrals are outlined. The problem of determining the current on a real antenna in the earth, including the effect of insulation, is considered. Results are included for the fields of a point source in homogeneous and stratified earths and the field of a finite insulated dipole. The results are for electromagnetic propagation in the ELF-VLF range, but the codes also can address propagation problems at higher frequencies.

**46926 (UCID—20497) Software requirements definition Shipping Cask Analysis System (SCANS).** Johnson, G.L.; Serbin, R. (Lawrence Livermore National Lab., CA (USA)). 21 Jul 1985. Contract W-7405-ENG-48. 49p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85017880.

The US Nuclear Regulatory Commission (NRC) staff reviews the technical adequacy of applications for certification of designs of shipping casks for spent nuclear fuel. In order to confirm an acceptable design, the NRC staff may perform independent calculations. The current NRC procedure for confirming cask design analyses is laborious and tedious. Most of the work is currently done by hand or through the use of a remote computer network. The time required to certify a cask can be long. The review process may vary somewhat with the engineer doing the reviewing. Similarly, the documentation on the results of the review can also vary with the reviewer. To increase the efficiency of this certification process, LLNL was requested to design and write an integrated set of user-oriented, interactive computer programs for a personal microcomputer. The system is known as the NRC Shipping Cask Analysis System (SCANS). The computer codes and the software system supporting these codes are being developed and maintained for the NRC by LLNL. The objective of this system is generally to lessen the time and effort needed to review an application. Additionally, an objective of the system is to assure standardized methods and documentation of the confirmatory analyses used in the review of these cask designs. A software system should be designed based on NRC-defined requirements contained in a requirements document. The requirements document is a statement of a project's wants and needs as the users and implementers jointly understand them. The requirements document states the desired end products (i.e. WHAT's) of the project, not HOW the project provides them. This document describes the wants and needs for the SCANS system. 1 fig., 3 tabs.

**46927 Solitons in Josephson junctions: An overview.** Lomdahl, P.S. (Center for Nonlinear Studies, Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Journal of Statistical Physics;* **39**: No. 3, 551-562(Jun 1985).

The dynamics of the Josephson tunnel junction is approximately described by a perturbed sine-Gordon equation. The Josephson tunnel junction is thus a convenient experimental solid state device for the study of solitons and solitonlike phenomena. The physical manifestation of the soliton is a propagating magneetic flux quantum ($Phi_0 = h/2e = 2.064 \times 10^{-15}$ V sec). Basic properties of the soliton and its relation to observable experimental quantities (zero field steps, microwave radiation, etc.) are reviewed. Recent direct measurements of the actual soliton profile are also mentioned.

**46928 Low-temperature magnetic refrigerator.** Barclay, J. A. (to The United States of America as represented by the United States Department of Energy). US Patent 4,507,927. 2 Apr 1985. Filed date 26 May 1983. vp.

PAT-APPL-498434.

The disclosure is directed to a low temperature 4 to 20 K. refrigeration apparatus and method utilizing a ring of magnetic material moving through a magnetic field. Heat exchange is accomplished in and out of the magnetic field to appropriately utilize the device to execute Carnot and Stirling cycles.

**46929 Apparatus producing constant cable tension for intermittent demand.** Lauritzen, T. (to The United States of America as represented by the United States Department of Energy). US Patent 4,504,023. 12 Mar 1985. Filed date 23 May 1984. vp.

PAT-APPL-612955.

The disclosed apparatus produces constant tension in superconducting electrical cable, or some other strand, under conditions of intermittent demand, as the cable is unreeled from a reel or

reeled thereon. The apparatus comprises a pivotally supported swing frame on which the reel is rotatably supported, a rotary motor, a drive train connected between the motor and the reel and including an electrically controllable variable torque slip clutch, a servo transducer connected to the swing frame for producing servo input signals corresponding to the position thereof, a servo control system connected between the transducer and the clutch for regulating the torque transmitted by the clutch to maintain the swing frame in a predetermined position, at least one air cylinder connected to the swing frame for counteracting the tension in the cable, and pressure regulating means for supplying a constant air pressure to the cylinder to establish the constant tension in the cable, the servo system and the clutch being effective to produce torque on the reel in an amount sufficient to provide tension in the cable corresponding to the constant force exerted by the air cylinder. The drive train also preferably includes a fail-safe brake operable to its released position by electrical power in common with the servo system, for preventing rotation of the reel if there is a power failure. A shock absorber and biasing springs may also be connected to the swing frame, such springs biasing the frame toward its predetermined position. The tension in the cable may be measured by force measuring devices engageable with the bearings for the reel shaft, such bearings being supported for slight lateral movement. The reel shaft is driven by a Shmidt coupler which accommodates such movement.

46930 **Multiple channel optical data acquisition system.** Fasching, G.E.; Goff, D.R. (to Dept. of Energy). US Patent Application 6-704,115. 22 Feb 1985. 28p. DE85017761 NTIS, PC A03/MF A01; GPO Dep. File Number DE85017761.

A multiple channel optical data acquisition system is provided in which a plurality of remote sensors monitoring specific process variable are interrogated by means of a single optical fiber connecting the remote station/sensors to a base station. The remote station/sensors derive all power from light transmitted through the fiber from the base station. Each station/sensor is individually accessed by means of a light modulated address code sent over the fiber. The remote station/sensors use a single light emitting diode to both send and receive light signals to communicate with the base station and provide power for the remote station. The system described can power at least 100 remote station/sensors over an optical fiber one mile in length.

46931 **Optical switch.** Reedy, R.P. (to Dept. of Energy). US Patent Application 6-692,760. 18 Jan 1985. 13p. Contract W-7405-ENG-48. DE85017783 NTIS, PC A02/MF A01; GPO Dep. File Number DE85017783.

An optical switching device is provided whereby light from a first glass fiber or a second glass fiber may be selectively transmitted into a third glass fiber. Each glass fiber is provided with a focusing and collimating lens system. In one mode of operation, light from the first glass fiber is reflected by a planar mirror into the third glass fiber. In another mode of operation, light from the second glass fiber passes directly into the third glass fiber. The planar mirror is attached to a rotatable table which is rotated to provide the optical switching.

46932 **Multi-port valve assembly.** Guggenheim, S.F. (to Dept. of Energy). US Patent Application 6-672,229. 16 Nov 1984. 23p. DE85017769 NTIS, PC A02/MF A01; GPO Dep. File Number DE85017769.

A multi-port fluid valve apparatus is used to control the flow of fluids through a plurality of valves and includes a web, which preferably is a stainless steel endless belt. The belt has an aperture therethrough and is progressed, under motor drive and control, so that its aperture is moved from one valve mechanism to another. Each of the valve mechanisms comprises a pair of valve blocks which are held in fluid-tight relationship against the belt. Each valve block consists of a block having a bore through which the fluid flows, a first seal surrounding the bore and a second seal surrounding the first seal, with the distances between the first and second seals being greater than the size of the belt aperture. In order to open a valve, the motor progresses the belt aperture to where it is aligned with the two bores of a pair of valve blocks, such alignment permitting a flow of the fluid through the valve. The valve is closed by movement of the belt aperture and its replacement, within the pair of valve blocks, by a solid portion of the belt.

46933 **Ultrafast gating of proximity focused microchannel-plate intensifiers.** Lundy, A.S.; Iverson, A.E. (Los Alamos National Lab., NM). *Proceedings of the Society of Photo-Optical Instrumentation Engineers;* **348**: 178-189(1982).

From 15. international congress on high speed photography and photonics; San Diego, CA, USA (21-27 Aug 1982).

Proximity-focused, microchannel-plate (MCP) image intensifiers have been used at Los Alamos for many years to allow single frame film and video exposure times in the range of 2.5 to 10 ns. There is now a program to reduce gating times to <1 ns. Previous work and the problems in achieving good resolution with gating times of <1 ns are reviewed. The key problems involve applying fast electrical gating signals to the tube elements. Computer modeling studies of the combined tube, tube connection, and pulser system are presented. It is shown that low photocathode surface resistivity must be obtained to permit fast gating between the photocathode and the MCP input. Ways of making low-resistivity S20 photocathodes, using gallium arsenide photocathodes, and various means of gating the tubes are discussed. A variety of pulser designs are being experimentally evaluated including spark gaps, avalanche transistors, Krytron tubes with sharpening gaps, step recovery diodes, and photoconductive elements (PCEs). The results of these studies are presented. Because of the high capacitances involved in most gating schemes, the tube connection geometry must be of low-impedance design, and our solution is presented. Finally, ways of testing these high-speed camera systems are discussed.

## 4203 Lasers

*REFER ALSO TO CITATION(S) 46815, 46885, 47047, 47048*

46934 **(LA-UR—85-2879) Gallium arsenide photocathode for the free electron laser.** Stotlar, S.C.; Springer, R.W.; Sherwood, B.; Cordi, R. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 11p. (CONF-850345—32). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85017557.

From Southwest conference on optics; Albuquerque, NM, USA (4 Mar 1985).

The efforts of the FEL source have been concentrated on cesiated GaAs(100) wafers. These crystals have shown photoyield of <.1 to 9% quantum efficiency with the cesium and oxygen treatment. The work function and coverage curves exhibit the same properties as measured in the literature. The use of Auger Electron Spectroscopy and X-ray Photoelectron Spectroscopy have been instrumental in determining the surface cleanliness and the surface oxidation states. The sputtered surfaces have been investigated as a function of rare gas mass and sputter ion voltage, giving similar results to earlier literature values. Temperature annealing appears to be critical after sputter cleaning in achieving any significant photoyield. Contacts of Ag-Mn and Ni-Si have been deposited, heated, and analyzed using Auger Depth Profiling techniques. 16 refs., 9 figs.

46935 **Energy extraction measurements of an electron beam pumped, high Kr concentration KrF laser at elevated temperatures.** Salesky, E.T.; Kimura, W.D. (Los Alamos National Laboratory, P. O. Box 1663, Los Alamos, New Mexico 87545). *Applied Physics Letters;* **47**: No. 8, 774-776(15 Oct 1985). Contract W-7405-ENG-36.

Energy extraction measurements are obtained with an electron beam pumped KrF laser for initial gas temperatures from 294 to 425 K. Gas mixtures investigated are 89.7% Ar/10% Kr/0.27% $F_2$ at 1.23 amagats and 99.6% Kr/0.4% $F_2$ at 0.81 amagats. These densities correspond to equivalent electron stopping powers and result in an average pump rate of roughly-equal120 kW/cm³. Measured efficiencies do not increase significantly with temperature, in sharp contrast to earlier predictions. The $Kr_2F$( fluorescence is monitored as a function of temperature, and lasing or nonlasing conditions. Although the $Kr_2F$( fluorescence emission does decrease during lasing conditions indicating partial saturation of the

molecule, the fluorescence also does not exhibit a strong temperature dependence. Computer simulations are in good agreement with the results when using an inverse square root temperature dependence for the $Kr_2F$( formation.

46936 **Dual frequency optical cavity.** George, E. V.; Schipper, J. F. (to The United States of America as represented by the United States Department of Energy). US Patent 4,510,605. 9 Apr 1985. Filed date 21 Mar 1983. vp.

PAT-APPL-477456.

Method and apparatus for generating two distinct laser frequencies in an optical cavity, using a "T" configuration laser cavity and means for intermittently increasing or decreasing the index of refraction n of an associated transmission medium in one arm of the optical cavity to enhance laser action in one arm or the second arm of the cavity.

46937 **Optical harmonic generator.** Summers, M. A.; Boyd, R. D.; Eimerl, D. (to The United States of America as represented by the United States Department of Energy). US Patent 4,510,402. 9 Apr 1985. Filed date 10 Jun 1982. vp.

PAT-APPL-387060.

A pair of uniaxial birefringent crystal elements are fixed together to form a serially arranged, integral assembly which, alternatively, provides either a linearly or elliptically polarized second-harmonic output wave or a linearly polarized third-harmonic output wave. The "extraordinary" or "e" directions of the crystal elements are oriented in the integral assembly to be in quadrature (90°). For a second-harmonic generation in the Type-II-Type-II angle tuned case, the input fundamental wave has equal amplitude "o" and "e" components. For a third-harmonic generation, the input fundamental wave has "o" and "e" components whose amplitudes are in a ratio of 2:1 ("o":"e" reference first crystal). In the typical case of a linearly polarized input fundamental wave this can be accomplished by simply rotating the crystal assembly about the input beam direction by 10°. For both second and third harmonic generation input precise phase-matching is achieved by tilting the crystal assembly about its two sensitive axes ("o").

46938 **Two dimensional optimization of free electron laser designs.** Prosnitz, D.; Haas, R. A. (to The United States of America as represented by the United States Department of Energy). US Patent 4,510,455. 9 Apr 1985. Filed date 4 May 1982. vp.

PAT-APPL-374655.

Off-axis, two-dimensional designs for free electron lasers that maintain correspondence of a light beam with a "synchronous electron" at an optimal transverse radius $r>0$ to achieve increased beam trapping efficiency and enhanced laser beam wavefront control so as to decrease optical beam diffraction and other deleterious effects.

46939 **Excimer laser phototherapy for the dissolution of abnormal growth.** Gruen, D.M.; Young, C.E.; Pellin, M.J. (to Dept. of Energy). US Patent Application 6-702,569. 19 Feb 1985. 18p. Contract W-31-109-ENG-38. DE85017803 NTIS, PC A02/MF A01; GPO Dep. File Number DE85017803.

Removal of abnormal human tissue with reduced thermal damage is achieved by selecting a laser having a wavelength in the order of 290 to 400 nm, orienting a laser-transmitting glass member toward the abnormal tissue and directing the laser through the glass member at power densities, pulse rates, and times sufficient to cause multiphoton absorption and bond breaking by Coulomb repulsion rather than thermal destruction. The glass member may include a laser beam concentrator provided by a lens or cone at the tissue-treatment end to increase the beam energy per unit area and reduce the treatment area. 6 figs.

46940 **Density gradient free electron collisionally excited x-ray laser.** Campbell, E.M.; Rosen, M.D. (to Dept. of Energy). US Patent Application 6-676,338. 29 Nov 1984. 30p. Contract W-7405-ENG-48. DE85017726 NTIS, PC A03/MF A01; GPO Dep. File Number DE85017726.

An operational x-ray laser is provided that amplifies 3p-3s transition x-ray radiation along an approximately linear path. The x-ray laser is driven by a high power optical laser. The driving line focused optical laser beam illuminates a free-standing thin foil that may be associated with a substrate for improved structural integrity. This illumination produces a generally cylindrically shaped plasma having an essentially uniform electron density and temperature, that exists over a long period of time, and provides the x-ray laser gain medium. The x-ray laser may be driven by more than one optical laser beam. The x-ray laser has been successfully demonstrated to function in a series of experimental tests.

46941 **Modeling gain saturation in neodymium laser glasses.** Hall, D.W.; Weber, M.J. (Corning Glass Works, NY). *IEEE (Institute of Electrical and Electronics Engineers) Journal of Quantum Electronics;* **QE-20**: No. 8, 831-834(Aug 1984). Contract W-7405-ENG-48.

Gain saturation in neodymium laser glasses was modeled using a simplified treatment of the spectroscopic inhomogeneities and experimental parameters obtained from broadband- and laser-excited fluorescence spectroscopy. The predicted large-signal gain behavior for two silicate and two phosphate glasses agrees with measured gain saturation within the experimental uncertainties. The results are extended to treat saturation of other Nd-doped glasses.

## 4204 Heat Transfer And Fluid Flow

*REFER ALSO TO CITATION(S) 46401, 46466, 46509, 46536*

46942 **(CEA-R—5289) Single phase and two-phase flow pressure losses through restrictions, expansions and inserts.** Glenat, P.; Solignac, P. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France)). Nov 1984. 54p. (In French). NTIS (US Sales Only), PC A04/MF A01. File Number DE85752137.

We give a selection of methods to predict pressure losses through retrictions, expansions and inserts. In single phase flow, we give the classical method based on the one-dimensional momentum and mass balances. In two-phase flow, we propose the method given by Harshe et al. and an empirical approach suggested by Chisholm. We notice the distinction between long and short inserts depends upon whether or not the vena contracta lies within insert. Finally, we propose three correlations to calculate void fraction through the singularities which have been considered.

46943 **(CONF-850758—2) Implicit mixed interpolation finite element algorithm for time dependent viscous flows utilizing a frontal solution technique.** Becker, B.R.; Drake, J.B. (Oak Ridge National Lab., TN (USA)). 1985. Contract AC05-84OR21400. 29p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85016357.

From 5. international conference on mathematical modelling; Berkeley, CA, USA (29 Jul 1985).

A finite element algorithm is described implements the Galerkin approximation to the Navier-Stokes equations and incorporates five predominate features. Although none of these five features is unique to this algorithm, their orchestration, as described in this paper, results in an algorithm which is not only easy to implement but also stable, accurate, and robust, as well as computationally efficient. The zero stress natural boundary condition is implemented which permits calculation of the outflow velocity distribution. A nine-node, Lagrangian, isoparametric, quadrilateral element is used to represent the velocity while the pressure uses a four-node, Lagrangian, superparametric element coincident with the velocity element. The easily implemented, computationally efficient frontal solution technique is used to assemble the element coefficient matrices, impose the boundary conditions, and solve the resulting linear system of equations. An implicit backward Euler time integration rule provides a very stable solution method for time dependent problems. A Picard scheme with a relatively large radius of convergence is used for iteration of the non-linear equations at each time step. Results are given from the calculations of two dimensional, steady-state and time-dependent convection dominated flows of viscous incompressible fluids.

**46944 (NBSIR—85-3026) Round robins on the apparent thermal conductivity of low-density glass fiber insulations using guarded hot plate and heat flow meter apparatus.** Hust, J.G.; Pelanne, C.M. (National Bureau of Standards, Boulder, CO (USA)). May 1985. Contract AC05-84OR21400. 131p. NTIS, PC A07/MF A01; 1; GPO Dep. File Number DE85017253.

This National Bureau of Standards report presents the results and the data analysis pertaining to these results for three round robins on the thermal performance of guarded hot plates and heat flow meters when measuring the thermal resistance properties of low density glass fibrous thermal insulations. The three round robins were carried out under the sponsorship of the American Society for Testing and Materials (ASTM) Subcommittee C-16.30 on Thermal Measurements and the Mineral Insulation Manufacturers Association (MIMA). The test results are compared to a reference equation and to each other to illustrate intralaboratory and interlaboratory reproducibility as well as the dependencies on temperature, density, plate emittance, specimen thickness, and fiber diameter. The study shows that, with good laboratory practices, interlaboratory agreeemnt of about 2% is obtained. Over 300 test results obtained by 12 different laboratories are reported. This report also discusses the magnitude of the specimen thickness effect and its dependence on plate emittance. 20 refs., 58 figs., 35 tabs.

**46945 (NP—5770372) Investigations on transition boiling of flowing water and electrically heated surfaces with temperature controlled heat input.** Kleen, U. (Technische Univ. Berlin (Germany, F.R.). Fachbereich Verfahrenstechnik). 28 Oct 1983. 241p. (In German). NTIS (US Sales Only), PC A11/MF A01. File Number DE85770372.

The paper proves that following local exceeding of the critical surface power density an almost erratically changed equilibrium condition is created on wires and thin-walled tubes, where nucleate boiling and film boiling areas remain stable next to each other. In this case, transition boiling only occurs in a very restricted space, accompanied by extremely steep axial temperature gradients. To execute measurements in the transition boiling zone, an electrically heated surface, a copper cylinder with internal flow has proved appropriate. Good heat conduction in axial direction guarantees a more uniform march of temperature. The energy is input by concentrically arranged heating elements, the current supply of which is controlled by a solid-state supply unit in a closed loop in a way as to maintain the axial average value of the temperature at the inner surface of the copper cylinder. When saturated water is boiled, setting to stationary transition boiling at the entire surface of the copper cylinder with only little temperature variation is possible. With subcooled boiling, local exceeding of the critical surface power density will cause S-shaped temperature profiles with continuous passing from nucleate boiling at the inlet area to film boiling at the outlet area. The dynamic behaviour of the closed loop was calculated analytically in the frequency range and subsequently tested by experiments with subcooled boiling, at maximum surface power density and with transition boiling. Proof was furnished that the closed loop has a good damping behaviour and that the reactions of the control to the time-history of the characteristic variations in temperature with transition boiling are low.

**46946 (SAND—85-0479) Derivation of finite element conductivity and capacitance matrices for 2- and 3-dimensional conduction heat transfer.** Nelsen, J.M. (Sandia National Labs., Albuquerque, NM (USA)). Jun 1985. Contract AC04-76DP00789. 43p. (TTC—0545). NTIS, PC A03/MF A01; GPO Dep. File Number DE85014344.

Current techniques commonly utilized in numerical heat transfer analysis carry imposed capability limitations. For example, finite difference formulated heat transfer analysis generally suffers from geometry restrictions. Similarly, finite element formulated heat transfer analyses typically linearize nonlinear transport mechanisms such as convection and radiation. This report considers the concept of beneficially linking the two methods, with the initial phase of such a hybridization derived in detail. 9 refs.

**46947 (UCID—20484) TOPAZ3D: a three-dimensional finite element heat transfer code.** Shapiro, A.B. (Lawrence Livermore National Lab., CA (USA)). Aug 1985. Contract W-7405-ENG-48. 61p. NTIS, PC A04/MF A01; GPO Dep. File Number DE85017878.

TOPAZ3D is a three-dimensional implicit finite element computer code for heat transfer analysis. This report provides a user's manual for TOPAZ3D and a description of the numerical algorithms used. Sample problems with analytical solutions are presented. TOPAZ3D has been implemented on the CRAY and VAX computers. TOPAZ3D can be used to solve for the steady state or transient temperature field on three dimensional geometries. Material properties may be temperature dependent and either isotropic or orthotropic. A variety of time and temperature dependent boundary conditions can be specified including temperature, flux, convection and radiation. By implementing the user subroutine feature, users can model chemical reaction kinetics and allow for any type of functional representation of boundary conditions and internal heat generation. TOPAZ3D can solve problems of diffuse and specular band radiation in an enclosure coupled with conduction in the material surrounding the enclosure. Additional features include thermal contact resistance across an interface, bulk fluids, phase change and energy balances. Thermal stresses can be calculated using the solid mechanics code NIKE3D which reads the temperature state data calculated by TOPAZ3D. TOPAZ3D is an extension of the two dimensional heat transfer code TOPAZ to three dimensions. TOPAZ3D is based to some extent on work by W.E. Mason and P.J. Burns in developing TACO3D. S.J. Sackett has been influential in the development of TOPAZ3D by writing the bandwidth and profile minimization routines, the equation solver FISSLE and many utility routines.

**46948 (WAPD-T—2865) Vectorization of diffusion computations in the presence of periodic boundary conditions.** Abu-Shumays, I.K. (Bettis Atomic Power Lab., West Mifflin, PA (USA)). May 1985. Contract AC11-76PN00014. 23p. (CONF-8510149—2). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85017631.

From Westinghouse engineering computer applications symposium; Monroeville, PA, USA (7 Oct 1985).

Solutions of very large three-dimensional elliptic diffusion problems are very expensive in terms of storage requirements and computational cost even on today's supercomputers. Effective utilization of translational or rotational periodic boundary conditions, when applicable, can substantially reduce cost. Implementation of periodic boundary conditions however is not straightforward and special care should be exercised to avoid loss of computational efficiency. Application of periodic boundary conditions perturbs the overall matrix structure of the underlying discretized diffusion equations and may adversely affect standard computational methods. For simplicity, this study is restricted to the solution of two-dimensional diffusion problems. The numerical solution methods considered are the point Chebyshev and line cyclic Chebyshev iterative methods. It is straightforward to implement periodic boundary conditions within the framework of the highly vectorizable point Chebyshev iterative method. This paper presents alternative approaches for implementing periodic boundary conditions within the framework of the line cyclic Chebyshev iteration method. In the process, the method of odd-even cyclic reduction as applied to vectorization of the solution of tridiagonal systems is generalized to apply to special sparse predominantly tridiagonal matrix equations. For two-dimensional problems, it is demonstrated numerically on a CYBER 205 for model situations that the resulting line cyclic Chebyshev iterative method is computationally superior to the highly vectorizable point Chebyshev iterative method. The superiority of the line cyclic Chebyshev method over the point Chebyshev method is expected to hold for more complex problems with general mesh triangulations.

**46949 (WAPD-T—2867) Relaxation parameters for the IQE iterative procedure for solving semi-implicit Navier-Stokes difference equations.** Anderson, J.H.; Hageman, L.A. (Bettis Atomic Power Lab., West Mifflin, PA (USA)). Jun 1985. Contract AC11-76PN00014. 21p. (CONF-8510149—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85017632.

From Westinghouse engineering computer applications symposium; Monroeville, PA, USA (7 Oct 1985).

Numerical solutions of the time-dependent Navier-Stokes equations for a thermally expandable fluid require advancing the unknown flow variables in time by either an implicit, a semi-implicit, or an explicit procedure. Explicit methods require a modest amount of computational effort per time step but require excessively small timestep lengths to ensure numerical stability. On the other hand, implicit and semi-implicit schemes allow the use of large timestep lengths but suffer from increased computational complexities. Fully-implicit methods generate coupled systems of nonlinear equations that must be solved at each point in time, whereas semi-implicit procedures generate coupled systems of linear equations. The focus of this paper is on the use of a recently formulated iterative procedure, called the IQE method, for solving the linear systems produced by a semi-implicit method. The IQE method, for solving the linear systems produced by a semi-implicit method. The IQE method requires the use of a relaxation parameter $\omega$ which must be properly chosen to obtain the greatest rate of convergence. Using heuristic arguments, we develop a numerical procedure for estimating near-optimal values of $\omega$. Numerical test results are included.

46950 **Visualization studies of a shear driven three-dimensional recirculating flow.** Koseff, J.R.; Street, R.L. (Stanford Univ., CA). *Journal of Fluids Engineering;* **106**: 21-29(Mar 1984). Contract AT03-81ER10867.

A facility has been constructed to study shear-driven, recirculating flows. In this particular study, the circulation cell structure in the lid-driven cavity was studied as a function of the speed of the lid which provides the shearing force to a constant and uniform density fluid. The flow is three-dimensional and exhibits regions where Taylor-type instabilities and Taylor Goertler-like vortices are present. One main circulation cell and three secondary cells are present for the Reynolds number (based on cavity width and lid speed) range considered, viz., 1000-10000. The flows becomes turbulent at Reynolds numbers between 6000 to 8000. The transverse fluid motions (in the direction perpendicular to the lid motion) are significant. In spite of this, some key results from two-dimensional numerical simulations agree well with the results of the present cavity experiments.

46951 **Flow visualization of a recirculating flow by rheoscopic liquid and liquid crystal techniques.** Rhee, H.S.; Koseff, J.R.; Street, R.L. (Stanford Univ., CA). *Experiments in Fluids;* **2**: 57-64(1984). Contract AT03-81ER10867.

Experiments were conducted in a three-dimensional lid-driven cavity flow to study the behavior of longitudinal Taylor-Goertler-like vortices. Flow visualization was accomplished by use of a rheoscopic liquid and of liquid crystals, together with laser-light and white-light sheets, respectively. Photographs of the lighted planes in the flow confirmed the existence of the vortices for a wide range of Reynolds numbers and for stable, neutrally-buoyant and buoyant global flow conditions. As usual the flow visualization revealed flow patterns not deducible by in situ measurements; the liquid crystal photographs give both flow pathlines and temperature distribution on any lighted plane.

## 4205 Materials Testing

*REFER ALSO TO CITATION(S) 46376, 46465, 46789*

46952 **(AECL—8354) Tomography. An overview of the CRNL program.** Allan, C.J.; Tonner, P.D. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.). Apr 1984. 16p. (CONF-8405317—1). NTIS (US Sales Only), PC A02/MF A01. File Number DE85701987.

From Workshop on product quality sensors; Hamilton, Ontario, Canada (8 May 1984).

Tomography is a non-invasive technique now being developed as an industrial tool. It will be most useful for studying complex geometries where other NDT techniques provide ambiguous information, and complex processes where the quantitative data obtained can be used to rigorously test our understanding of the process. An overview of the CRNL program is presented.

46953 **(CEA-CONF—7679) New trends in industrial X-ray tomography.** Huet, J.; Thomas, G.; Darieb, P. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France)). Oct 1984. 12p. (In French). (CONF-8410204—2). NTIS (US Sales Only), PC A02/MF A01. File Number DE85752166.

From 3. European conference on nondestructive testing; Florence, Italy (15 Oct 1984).

Based on his own NDT experience and the wants of important industrial testing laboratories, the CEA has studied a versatile X Ray 420 kV tomograph for the control of materials and structures. This project and the results obtained with a laboratory prototype are presented.

46954 (CONF-8111229—, pp vp) **New non-destructive and standardless method for the determination of thin films by XRF measurement.** Gries, W.H.; Wybenga, F.T. (Council for Scientific and Industrial Research, Pretoria, South Africa). 1981. National Physical Research Laboratory, CSIR, P.O. Box 395, Pretoria, 0001, South Africa.

From Symposium on surface science and its industrial implications; Pretoria, South Africa (1 Nov 1981).

The thickness of thin uniform films can be determined by measuring the signal ratio of a fluorescent line at two different take-off angles and using the result in either of two mathematical relationships which link the ratio to the film thickness. A zinc sulphide film on silica is used as an example for application of this method.

46955 **(EGG-MS—6872) Spot weld parameter development for joining thin sheath to plate using the gas metal arc welding process.** Watkins, A.D. (EG and G Idaho, Inc., Idaho Falls (USA)). Jun 1985. Contract AC07-76ID01570. 34p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85017494.

The gas metal arc welding process was shown to be a viable substitute for riveting in attaching thin sheaths to relatively thick plate. Welding process parameters were developed and characterized. Different material coatings at the sheath-to-plate interface were investigated with respect to their affect on the integrity of the spot weld.

46956 **(ETEC-TDR—85-5) Molten salt freeze seal. Final report.** Corugedo, J.J. (Energy Technology Engineering Center, Canoga Park, CA (USA)). 1 Aug 1985. Contract AC03-76SF00700. 35p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85017427.

This report documents the results of the testing performed at Sandia National Laboratory, Albuquerque, New Mexico, on the applicability of a sodium freeze seal type valve stem in a molten salt environment. The freeze seal tests consisted of cycling the valve stem at set temperature intervals, checking the temperature distribution for freeze plug location, and verifying the actuator forces. In addition to the test results, this report also documents the engineering analysis and other tasks performed before testing to form a basis for predicted test conditions and recommendations for the test program.

46957 (INIS-mf—9742, pp 34-39) **Application of 3 mg $^{252}$Cf neutron source in neutron autoradiography.** Freyer, K.; Treutler, H.Ch.; Weisse, S.; Bekler, M. (Akademie der Wissenschaften der DDR, Leipzig. Zentralinstitut fuer Isotopen- und Strahlenforschung). 1983. (In German). NTIS (US Sales Only), PC A12/MF A01. File Number DE85781598. (CONF-8305206—).

From 13. international symposium on autoradiography; Tabor, Czechoslovakia (2 May 1983).

The design is described of an irradiation facility with a 3 mg $^{252}$Cf neutron source and $H_2O$ moderator for quantitative neutron-induced autoradiography (NIAR). The important characteristics of the neutron fields in the irradiated container are given such as stability, quality and neutron flux density. The maximum neutron flux at day of production was 1.3 to 1.8 x $10^7$ $s^{-1}$. The advantage of the Cf sources as against the reactor is the reproducibility of neutron fluence in individual positions, simpler handling of samples and easy adjustment of irradiation equipment. Practical experience with this

Cf source is presented on the example of NIAR of boron and the life of the source is estimated. (Ha).

46958 (INIS-mf—9742, pp 63-69) **Choice of split size for optical density measurement of alloys autoradiographs.** Radwan, M. (Politechnika Poznanska (Poland)). 1983. NTIS (US Sales Only), PC A12/MF A01. File Number DE85781598. (CONF-8305206—).

From 13. international symposium on autoradiography; Tabor, Czechoslovakia (2 May 1983).

In any alloy a region exists in which the composition of structural elements corresponds to the mean contents of metals forming the alloy. A region for which we can prove the presence of all alloy structural elements in the amount corresponding to the mean concentration, is called specific region. The rules of the choice of the split size for optical density measurement are presented and the claim that the split size for the optical density measurement should be equal to the specific region size is verified. The verification was accomplished using pattern autoradiographs. (author).

46959 (INIS-mf—9742, pp 114-126) **Application of the quantitative autoradiography for determination of specific activity of labelled non-metallic inclusions.** Kowalczyk, J.T.; Wilczynski, A.W. (Uniwersytet Slaski, Katowice (Poland)). 1983. NTIS (US Sales Only), PC A12/MF A01. File Number DE85781598. (CONF-8305206—).

From 13. international symposium on autoradiography; Tabor, Czechoslovakia (2 May 1983).

The knowledge of specific activity of labelled non-metallic inclusions, i.e. the knowledge of the content of the radiotracer in a single inclusion, allows to obtain new information about the mechanism and the kinetics of steel deoxidation. In order to determine this specific activity quantitative autoradiography was used. For this purpose, various standards of aluminium oxides with different amounts of cerium oxide $Ce_2O_3$ and an aluminium-cerium alloy were prepared. The standards and the alloy were activated with thermal neutrons. Then several autoradiographs were made for these standards (ORWO AF-3 films were used). The autoradiographs served as the basis for evaluation of the standardization curves: optical density versus dimension of particles for a constant cerium concentration; optical density versus concentration of cerium for a constant dimension of particle. The samples of liquid steel were deoxidated with Al-Ce alloy. After labelled non-metallic inclusions had been isolated, the autoradiographs were made under the same conditions as for the standards. The standardization curves were used to determine the cerium content in the single inclusions. (author).

46960 (INIS-mf—9742, pp 140-150) **Use of autoradiographic methods in wear studies.** Szili, S.; Varkonyi, A. (Magyar Tudomanyos Akademia, Budapest. Izotopintezete). 1983. NTIS (US Sales Only), PC A12/MF A01. File Number DE85781598. (CONF-8305206—).

From 13. international symposium on autoradiography; Tabor, Czechoslovakia (2 May 1983).

In recent years, wear of tools for the plastics industry was studied by radioisotope methods. The aim of these tests was to determine the wear index, i.e. the change in the relative wear rate of different tools in processing filled or unfilled resins. Krypton technique was applied for wear tests of tools. Radiation intensity was measured of kryptonated surfaces before and after the experiment and the wear rate was calculated from the decrease in the intensity. The intensity was detected by means of autoradiography, the density of the autoradiograms was recorded with a DFK-10 densitometer. Some wear processes were investigated by the surface activation technique. The tested material was irradiated with charged particles (10 MeV protons), and the radioisotopes $^{56}Co$ and $^{57}Co$ were used. The distribution of the activity for various depths under the activated steel surface was demonstrated and evaluated. (author).

46961 (INIS-mf—9742, pp 151-159) **Application of SSNTD for brazed bond technology of high temperature Ni-base alloys.** Mysak, F.; Krejci, M.; Hakl, J.; Smrkovsky, E. (Statni Vyzkumny Ustav Materialu, Prague (Czechoslovakia)). 1983. NTIS (US Sales Only), PC A12/MF A01. File Number DE85781598. (CONF-8305206—).

From 13. international symposium on autoradiography; Tabor, Czechoslovakia (2 May 1983).

Alpha autoradiography using solid state nuclear track detectors (SSNTD) has proved very suitable for the evidence of the presence, distribution and concentration of alpha emitters. The method was used for testing brazed bond technology for high temperature Ni-base alloys. A brazing metal of similar composition as the base material, with an addition of 2.5 to 3% of boron was used for bonding. The main factors influencing the quality of bonds, i.e., the breadth of the bonding gap, post-bond annealing temperature and heating time were studied. Autoradiography seems to be a very useful method also for the detection of rejects. (author).

46962 (INIS-mf—9742, pp 216-222) **Autoradiographic imaging of macropores in concrete using sup(99m)Tc and analysis of their size and structure by means of Densitron computer analyzer data.** Baumbach, H.; Bretschneider, G.; Haering, P. (Technische Hochschule, Leipzig (German Democratic Republic)); Hartmann, G.; Kulicke, P.; Kummer, G. (Akademie der Wissenschaften der DDR, Leipzig. Zentralinstitut fuer Isotopen- und Strahlenforschung). 1983. (In German). NTIS (US Sales Only), PC A12/MF A01. File Number DE85781598. (CONF-8305206—).

From 13. international symposium on autoradiography; Tabor, Czechoslovakia (2 May 1983).

The objective of the work was to develop a method of the homogeneous filling of macropores and their autoradiographic imaging which will allow the evaluation of not only pore cross section but also of their depth distribution. The method of waterproofing concrete samples is described which allows to homogeneously fill the macropores (more than 1 $\mu$ in size) with aqueous solution of sup(99m)Tc. The autoradiograms were evaluated using the DENSITRON 3 instrument for image evaluation with the off-line BDG 2 digitizer. A significant part of the work is the software for image processing and evaluation which allows the determination of rate, surface, volumes and structural parameters. (Ha).

46963 (LA-UR—85-2349) **Synchrotron based measurements of the soft x-ray performance of thin film multilayer structures.** Kania, D.R.; Bartlett, R.J.; Trela, W.J. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 21p. (CONF-8508104—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85015679.

From Application of thin filmed multilayered structures to figured x-ray optics; San Diego, CA, USA (18 Aug 1985).

Using synchrotron radiation, measuring system has been developed to test the performance of layered synthetic microstructures (LSMs) from 50 to 500 eV. The measurement techniques are reviewed, and results are compared to theoretical predictions of LSM performance. (LEW)

46964 (LA-UR—85-2840) **Scattering of elastic waves by small surface-breaking or subsurface cracks in three dimensions.** Visscher, W.M. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 10p. (CONF-8506110—2). NTIS, PC A02/MF A01; GPO Dep. File Number DE85017564.

From Review of progress in quantitative NDE; Williamsburg, VA, USA (23 Jun 1985).

The long-wavelength limit of elastic wave scattering by surface cracks in 3d is considered. It is shown that, if the crack is normal to the surface, the scattering can be described by two real parameters, one of which may be taken to be the crack size. The other therefore depends on shape, orientation, and burial depth. Many computed illustrations are given. It is concluded that the amount of information about cracks obtainable by low frequency elastic wave scattering is very limited.

46965 (PNL-SA—10459) **Fabrication of cracks for ultrasonic procedures and personnel qualifications.** Clark, R.A.; Dudder, G.B.; Becker, F.L. (Pacific Northwest Labs., Richland, WA (USA)). May 1982. Contract AC06-76RL01830. 5p. NTIS.

It is recognized that procedure and personnel qualifications are key to the success of nondestructive examinations. The effec-

tiveness of a qualification test depends on the nature of the test samples. Realistic samples with flaws typical of those generated in-service, i.e., cracks, have been difficult to obtain or produce. Requirements for qualification test samples should include representative geometry and material conditions, and conservative flaw characteristics. The flaws should be short, tight, of typical orientation and location, as well as a typical crack morphology. Two flaw fabrication techniques which meet these criteria include: the thermal fatigue and graphite wool techniques. The thermal fatigue technique is capable of producing tight surface connected fatigue cracks of aspect ratio approaching 2:1 and is adaptable to a wide range of component geometries. The graphite wool technique is employed for the generation of integranular stress corrosion cracks (IGSCC) in austenitic pipe which very nearly duplicates service generated IGSCC. These two techniques are discussed.

46966 **(RKS—83-07) Ultrasonic testing. Conceptions and conditions in testing welds on austenitic steels.** Edman, G.; Egerbo, A. (Nuclear Safety Board of Swedish Utilities, Stockholm). Jul 1984. 30p. (In Swedish). NTIS (US Sales Only), PC A03/MF A01. File Number DE85702166.

Ultrasonic testing is presented, and different techniques are discussed. Advantages and disadvantages of ultrasonic testing are listed. Specifically, austenitic steels give some difficulties caused by grain sizes and elastic anisotropy.

46967 **(SAND—84-1739C) Multiaxial deformation testing: non-proportional loading and elevated temperatures.** Bourcier, R.J.; Jones, W.B. (Sandia National Labs., Albuquerque, NM (USA)). 1985. Contract AC04-76DP00789. 13p. (CONF-851029—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85007107.

From IMOG subgroup meeting; Livermore, CA, USA (8 Oct 1985).

A test system has been developed which allows cyclic multiaxial deformation testing along nonproportional loading paths in effective strain control. This is accomplished by the use of incremental plasticity theory to perform running effective plastic strain calculations during the test. The use of an elastic correction scheme allows plastic strain to be determined with less than approximately 50 microstrain apparent error for all paths examined to date.

46968 **(SKI-B—44-84) Intergranular stress corrosion sensitivity in stabilized stainless steels.** Bengtsson, B.; Korhonen, S.; Ljungberg, L. (Swedish Nuclear Power Inspectorate, Stockholm; ASEA-ATOM AB, Vaesteraas (Sweden)). May 1984. 15p. (In Swedish). NTIS (US Sales Only), PC A02/MF A01. File Number DE85702167.

Stabilized stainless steels are used in ASEA-ATOM BWR's in a number of forged and casted components, viz. valve housings. Samples of steels that are Ti-stabilized have been analyzed for carbon, and then CERT-tested for intergranular stress corrosion (IGSCC). The steels tested are Sandvik 8R30 and VEW A700. The medium was water with 8 ppm $O_2$ and at 286 degreeC, and a feed conductivity of less than 0.1$\mu Scm^{-1}$. The tests show that the zone near welds in these stabilized steels which in strongly oxidizing acids are sensitive to knife line attack, are also in BWR systems sensitive to IGSCC. This type of corrosion can be inhibited by minimizing the carbon content of the steels.

46969 **Surface studies by optical second harmonic generation: An overview.** Shen, Y.R. (Department of Physics, University of California, Berkeley, California 94720). *Journal of Vacuum Science and Technology, B: Microelectronics Processing and Phenomena;* 3: No. 5, 1464-1466(Sep 1985).

Optical second harmonic generation for surface and interface studies is briefly reviewed, with numerous examples illustrating how powerful and versatile this new surface analytical technique can be.

46970 **Predicting threshold and location of laser damage on optical surfaces.** Siekhaus, W. (to Dept. of Energy). US Patent Application 6-697,828. 4 Feb 1985. 28p. Contract W-7405-ENG-48. DE85017793 NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85017793.

Disclosed is an apparatus useful in the prediction of the damage threshold of various optical devices, the location of weak spots on such devices and the location, identification, and elimination of optical surface impurities. The apparatus comprises a focused and pulsed laser, a photo electric detector/imaging means, and a timer. The weak spots emit photoelectrons when subjected to laser intensities that are less than the intensity actually required to produce the damage. The weak spots may be eliminated by sustained exposure to the laser beam.

## 4206 Safety Engineering

46971 **(UCRL—53582-Rev.1) Natural phenomena hazards modeling project: seismic hazard models for Department of Energy sites. Revision 1.** Coats, D.W.; Murray, R.C. (Lawrence Livermore National Lab., CA (USA)). Nov 1984. Contract W-7405-ENG-48. 90p. NTIS, PC A05/MF A01; GPO Dep. File Number DE85017892.

Seismic and wind hazard models have been developed as part of a three-phase effort aimed at establishing uniform building design criteria for seismic and wind hazards at DOE sites throughout the United States. In Phase 1, LLNL gathered information on the sites and their critical facilities, including nuclear reactors, fuel-reprocessing plants, high-level waste storage and treatment facilities, and special nuclear material facilities. In Phase 2, development of seismic and wind hazard models, was initiated. These hazard models express the annual probability that the site will experience an earthquake or wind speed greater than some specified magnitude. This report summarizes the final seismic hazard models and response spectra recommended for each site and the methodology used to develop these models. 15 refs., 3 figs., 2 tabs.

46972 **(UCRL—93226) Natural phenomena hazards project for Department of Energy sites.** Coats, D.W. Jr. (Lawrence Livermore National Lab., CA (USA)). Aug 1985. Contract W-7405-ENG-48. 9p. (CONF-8510118—5). NTIS, PC A02/MF A01; GPO Dep. File Number DE85017699.

From DOE natural phenomena hazards mitigation conference; Las Vegas, NV, USA (7 Oct 1985).

Lawrence Livermore National Laboratory (LLNL) has developed seismic and wind hazard models for the Office of Nuclear Safety (ONS), Department of Energy (DOE). The work is part of a three-phase effort aimed at establishing uniform building design criteria for seismic and wind hazards at DOE sites throughout the United States. In Phase 1, LLNL gathered information on the sites and their critical facilities, including nuclear reactors, fuel-reprocessing plants, high-level waste storage and treatment facilities, and special nuclear material facilities. In Phase 2, development of seismic and wind hazard models was initiated. These hazard models express the annual probability that the site will experience an earthquake or wind speed greater than some specified magnitude. In the final phase, it is anticipated that the DOE will use the hazard models to establish uniform criteria for the design and evaluation of critical facilities. 13 refs., 2 figs.

## 4207 Vacuum Engineering

*REFER ALSO TO CITATION(S) 46814, 47144*

46973 (EGG/10282—1057, pp 8.1-8.10) **Ion-pumped vacuum systems for downhole applications.** Still, G.J. (EG and G Energy Measurements Inc., San Ramon, CA). Jan 1985. NTIS, PC A19/MF A01. File Number DE85010212. (CONF-830286—).

From Symposium on remote sensing technology; Las Vegas, NV, USA (23 Feb 1983).

Many physics experiments used for nuclear diagnostics measure low energy particle emission as a function of time. Transmission of these particles from source to detector typically must occur in a rarefied or vacuum environment. In instances where the experiment is buried in the earth, ion pumps have been successfully used to produce vacuum pressures on the order of $10^{-4}$ Pa ($10^{-6}$ torr). In this application, ion pumps offer significant advantages compared to other pump types. Because of their simplicity, ion-pumped vacuum systems are inherently reliable. Only one coaxial cable is required

to both power the system and monitor the pressure. Ion pumps remove gas through an ionization process. Since the vacuum pressure is directly proportional to ion current at these pressures, no additional instrumentation is required for pressure measurement. Some of the specifics associated with these systems and some of the steps taken to assure system reliability are discussed.

46974 **Correction of a vacuum design fault in leak detectors.** Langley, R.A. (Fusion Energy Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37830). *Journal of Vacuum Science and Technology, A: Vacuum, Surfaces, and Films;* 3: No. 5, 2040-2041(Sep 1985).

A design fault in the vacuum system of the MS 170 Leak Detector has been corrected by reorienting the vent valve. Other type of leak detectors, most notable the Leybold-Heraeus Model F, have had similar faults that can probably be corrected with a similar type of modification. (AIP)

## 4208 Electronic Circuits And Devices

*REFER ALSO TO CITATION(S) 47956*

46975 **(AD-A—154987/2/XAB) Optical output stabilization method for direct-current arc lamps. Interim technical report.** Oldham, P.B.; Patonay, G.; Warner, I.M. (Emory Univ., Atlanta, GA (USA). Dept. of Chemistry). 30 Apr 1985. 24p. NTIS, PC A02/MF A01.

A simple, effective technique for stabilizing the optical output of direct-current (dc) arc lamps is described. The large output fluctuation due to arc wander in a commercially available lamp and power supply is minimized by the introduction of an alternating-current (ac) waveform superimposed on the dc-source voltage in conjunction with detector averaging. Arc stability is monitored indirectly by the detection of arc-excited fluorescence from a standard sample. The monitored lamp output is typically maintained to within 1% relative standard deviation (RSD) by this method. Data are presented supporting the theory that arc wander is significantly reduced by the addition of an ac component to the dc lamp power. Various methods of ac introduction are discussed along with the design of a controllable oscillator circuit. The effects of variations in ac voltage and frequency on optical output stability are examined.

46976 (CONF-8111229—, pp vp) **Integrated circuit failure mechanism detected by IMMA.** Crooke, M. (Council for Scientific and Industrial Research, Pretoria, South Africa). 1981. National Physical Research Laboratory, CSIR, P.O. Box 395, Pretoria, 0001, South Africa.

From Symposium on surface science and its industrial implications; Pretoria, South Africa (1 Nov 1981).

Unanticipated lateral field effect transistor (FET) action was observed between parts of an integrated circuit (IC) during electrical probing. Although comprehensive electrical investigation lead to the identification of potentially suspect areas, and reduced the possible origins of the problem to three, it was only after application of the technique of ion microprobe mass analysis (IMMA) in the suspect areas that the problem was unambiguously identified. Based on this, a mechanism of failure was proposed which was subsequently confirmed by direct observation of the critical event.

46977 **Audiofrequency measurement of JFET noise versus temperature in a high-impedance preamplifier.** Klein, S.; Innes, W.; Price, J.C. (Stanford Linear Accelerator Center, Stanford University, Stanford, California 94305). *Review of Scientific Instruments;* 56: No. 10, 1941-1945(Oct 1985).

We describe a high-impedance audiofrequency preamplifier and present audiofrequency noise spectra for 2N4416 and U311 JFETs in a temperature range from room temperature to 80 K. It is found that optimum noise performance is obtained at -140°C. We present an analysis of some of the sources of noise. Amplifier input capacitance is also measured and discussed.

46978 **Process for fabricating ZNO-based varistors.** Lauf, R. J. (to The United States of America as represented by the Department of Energy). US Patent 4,510,112. 9 Apr 1985. Filed date 21 Jan 1983. vp.

PAT-APPL-459922.

The invention is a process for producing ZnO-based varistors incorporating a metal oxide dopant. In one form, the invention comprises providing a varistor powder mix of colloidal particles of ZnO and metal-oxide dopants including $Bi_2O_3$. The mix is hot-pressed to form a compact at temperatures below 850° C. and under conditions effecting reduction of the ZnO to sub-stoichiometric oxide. This promotes densification while restricting liquid formation and grain growth. The compact then is heated under conditions restoring the zinc oxide to stoichiometric composition, thus improving the varistor properties of the compact. The process produces fine-grain varistors characterized by a high actual breakdown voltage and a high average breakdown voltage per individual grain boundary.

46979 **Low pressure spark gap triggered by an ion diode.** Prono, D. S. (to The United States of America as represented by the United States Department of Energy). US Patent 4,507,589. 26 Mar 1985. Filed date 31 Aug 1982. vp.

PAT-APPL-413639.

Spark gap apparatus for use as an electric switch operating at high voltage, high current and high repetition rate. Mounted inside a housing are an anode, cathode and ion plate. An ionizable fluid is pumped through the chamber of the housing. A pulse of current to the ion plate causes ions to be emitted by the ion plate, which ions move into and ionize the fluid. Electric current supplied to the anode discharges through the ionized fluid and flows to the cathode. Current stops flowing when the current source has been drained. The ionized fluid recombines into its initial dielectric ionizable state. The switch is now open and ready for another cycle.

46980 **Pulse-excited, auto-zeroing multiple channel data transmission system.** Fasching, G.E. (to Dept. of Energy). US Patent Application 6-704,114. 22 Feb 1985. 17p. DE85017760 NTIS, PC A02/MF A01; GPO Dep. File Number DE85017760.

A multiple channel data transmission system is provided in which signals from a plurality of pulse operated transducers and a corresponding plurality of pulse operated signal processor channels are multiplexed for single channel FM transmission to a receiving station. The transducers and corresponding channel amplifiers are powered by pulsing the dc battery power to these devices to conserve energy and battery size for long-term data transmission from remote or inaccessible locations. Auto zeroing of the signal channel amplifiers to compensate for drift associated with temperature changes, battery decay, component aging, etc., in each channel is accomplished by means of a unique auto zero feature which between signal pulses holds a zero correction voltage on an integrating capacitor coupled to the corresponding channel amplifier output. Pseudo-continuous outputs for each channel are achieved by pulsed sample-and-hold circuits which are updated at the pulsed operation rate. The sample-and-hold outputs are multiplexed into an FM/FM transmitter for transmission to an FM receiver station for demultiplexing and storage in separate channel recorders.

## 4209 Waste Processing Plants And Equipment

*REFER ALSO TO CITATION(S) 46704*

## 4210 Combustion Systems

*REFER ALSO TO CITATION(S) 46049, 46260, 46696, 46748, 46908*

46981 **(BMFT-FB-T—85-064) Development of low-emissions gas turbine combustion systems.** Berenbrink, P.; Rosen, V.; Schabbehard, H.W. (Bundesministerium fuer Forschung und Technologie, Bonn (Germany, F.R.)). Jul 1985. 180p. (In German). NTIS (US Sales Only), PC A09/MF A01. File Number DE85752702.

1. Objective: Development and investigation of gas turbine combustion systems with reduced emissions in particular the oxides of nitrogen. 2. Work-Programme: 2.1 Investigations for existing diffusion flame burner improvement to reduce emissions by modifications of the burner and fuel nozzle geometry and by wet NOsub(x)-control. 2.2 Development of a premixed flame burner. 2.3 Development of a calculation procedure for predicting the formation of pollutants in a GT-combustion chamber. 3. Results: For the diffusion flame burner the NOsub(x)-emissions have been reduced to one third, with wet control of one tenth of those of the initial burner. For gaseous fuel a premixed flame burner with low NOsub(x)-emission is available, for liquid fuel more research work is necessary. A procedure for flow field and chemical reactions calculations has been developed.

46982 **(EFN—7) Combustion technology. An assessment of the governmental support to research and development.** (Energiforskningsnaemnden, Stockholm (Sweden)). Jun 1984. 83p. (In Swedish). NTIS (US Sales Only), PC A05/MF A01. File Number DE85752509.

During the period 1975 to 1983 the total financial support has been 134 MSEK for a total of 292 projects. The assessment has been of an overall and long term nature and has been concentrated to combustion technology for solid fuels in stationary applications. The planning and administration of the financial support has on the whole been in agreement with the official policy. The support is criticized for two reasons: a lack of responsibility for the acquisition of knowledge and skill on a long term and a poor link between support to different types of combustion technology research and development. Education on a basic or advanced level has not been accomplished. The commission presents propositions and recommendations based on the findings of the assessment.

46983 **(KC—84/02d) Materials in condensing boilers.** Jansen, P. (Korrosionscentralen, Glostrup (Denmark)). [1985]. 26p. (In Danish). NTIS (US Sales Only), PC A03/MF A01. File Number DE85752631.

This is a review of corrosion and materials problems in condensing boilers for oil and gas. In the condensing boiler the fluegas is cooled below the water dewpoint of 45-48sub(o)C with gasoil and 55-58sub(o)C with natural gas. Materials for the three zones of the boiler: Combustion chamber, condensing heatexchanger, outlet ducting and stack are discussed based on literature data and experience with condensing boilers in Denmark. This includes steel, cast iron, stainless steels, aluminium copper alloys, glass and plastics. Finally a short presentation of condensing domestic boilers available in Denmark in 1983 is given.

46984 **(NP—5752635) Combustion - calculation of losses and efficiency.** Gundtoft, S. (Jydsk Teknologisk Institut, Aarhus (Denmark)). 1984. 36p. (In Danish). NTIS (US Sales Only), PC A03/MF A01. File Number DE85752635.

EFP-83.

During the practical work with boilers a calculation of the efficiency of the boiler is often of interest. The efficiency is defined as the ratio between the supplied heat and the energy quantity of the fuel added. The efficiency can be calculated in two ways: The 'direct method' and the 'indirect method'. When working on improving and optimizing the combustion process and the heat exchange, the 'indirect method' is often used for the calculation of the efficiency of heating systems in practice where it may be difficult to measure the heat output and the fuel consumption directly. The present report outlines a calculation procedure according to the indirect method. The aim has been to collect the relatively few formulae in one concentrated, practically applicable form. The calculation procedure, which has mainly been taken from DIN 4702, Teil 2, applies to an arbitrary solid, liquid or gaseous fuel with a known calorific value and elementary analysis.

46985 (SBI-MEDD—48, pp 52-57) **Boiler room losses.** Bodal, E. (Dansk Kedelforening, Copenhagen). 1984. (In Danish). NTIS (US Sales Only), PC A08/MF A01. File Number DE85752645. (CONF-8303204—).

From Energy control in greenhouse gardening; Tune, Denmark (1 Mar 1983).

EFP-81, EFP-82, EFP-83.

A basis for good energy economy is that the losses, that arises by heating the boiler water, are kept on a minimum. The losses occour partly in the boiler by combustion and by draught under lay-up and partly in the boiler room by heat loss from the boiler and from the heat pipes. Different techniques can be used to secure that the largest possible part of the energy of the oil is transferred to the heating system. The different techniques, that are described, are: cleaning of the flue gas side, cleaning of the water side, heat recovery of flue gas, lay-up shunts and damper, insulation of the heat producing system.

46986 **(STUDSVIK-NR—83-334) Data acquisition system for a fast fluidized bed.** Bergdahl, B.G. (Studsvik Energiteknik AB, Nykoeping (Sweden)). 5 Dec 1983. 36p. (In Swedish). (STUDSVIK-EB—83-170). NTIS (US Sales Only), PC A03/MF A01. File Number DE85752512.

This data acquisition system makes use of the minicomputer NORD 100. Processed data are stored on a floppy disk and they include 58 temperatures, 21 differential pressures and 7 other pressures, fuel flows, oxygen contents and primary effect.

46987 **(VTT-TUTK—324) Boiler design model.** Miettinen, M.; Huotari, J.; Asplund, D. (Valtion Teknillinen Tutkimuskeskus, Espoo (Finland)). Dec 1984. 139p. (In Finnish). NTIS (US Sales Only), PC A07/MF A01. File Number DE85752566.

A mathematical model has been developed for designing boilers of district heating size. Grate boilers, which use direct combustion method of solid domestic fuels, are sized thermally with the model, based on the information on fuel, and the desired boiler structure. The influence of the chosen design parameters and the fuel properties on the sizing and efficiency is examined by the model. A boiler is sized according to the properties of the fuel in use. The combustion temperature and heat transfer reached in the furnace and the amounts of substances which flow in the process are affected by the design fuel moisture and the heating value of the fuel. Empiric heat transfer rates can be utilized in sizing furnaces. The final temperature of gas in the furnace is determined according to the ignition temperature of the combustible gases and the softening characteristics of the fuel ash. Sizing principles have to be developed for more detailed sizing. The decreasing of the design temperature of flue gas improves the efficiency of the boiler. The decreasing of the final temperature from 570 K to 430 K improves the efficiency of the boiler 10%, but the convective heat transfer surfaces have to be increased by over 60%.

46988 **Kiln for hot pressing compacts in a continuous manner.** Reynolds Jr., C. D. (to The United States of America as represented by the United States Department of Energy). US Patent 4,510,363. 9 Apr 1985. Filed date 8 Aug 1983. vp.

PAT-APPL-521496.

The present invention is directed to a hot pressing furnace or kiln which is capable of preheating, hot pressing, and cooling a plurality of articles in a sequential and continuous manner. The hot pressing furnace of the present invention comprises an elongated, horizontally disposed furnace capable of holding a plurality of displaceable pusher plates each supporting a die body loaded with refractory or ceramic material to be hot pressed. Each of these plates and the die body supported thereby is sequentially pushed through the preheating zone, a temperature stabilizing and a hot pressing zone, and a cooling zone so as to provide a continuous hot-pressing operation of a plurality of articles.

## 4240 Pollution Control Equipment

*REFER ALSO TO CITATION(S) 45978, 46397, 47212, 47213*

# 43 PARTICLE ACCELERATORS

## 4301 Design, Development, And Operation

*REFER ALSO TO CITATION(S) 47907, 47949*

**46989 (CONF-850128—) Laser acceleration of particles. AIP conference proceedings No. 130.** Joshi, C.; Katsouleas, T. (eds.). (American Inst. of Physics, New York). 1985. Contract FG03-84ER40184. 627p. American Inst. of Physics, 335 East 45th Street, New York, NY 10017. File Number TI85017258.

From 2. international workshop on laser acceleration of particles; Los Angeles, CA, USA (7 Jan 1985).

The Second Workshop on Laser Acceleration of Particles was held at UCLA on January 7-17, 1985. Despite the title, the workshop broadened to include studies of all novel acceleration schemes, whether lasers are involved or not. Substantial progress both theoretical and experimental has been made on all three basic types of laser accelerators: near field, far field, and plasma accelerators. Understandings gained from detailed studies of problems on laser excitation and propagation and on particle beam containment and stability have led to concentrations on those specific schemes which appear to be the most promising. (A) near field accelerator; (B) far field accelerator; and (C) plasma accelerator. For non-laser accelerators, the wakefield or two-beam acceleration schemes are the most promising and have received the most attention. In both schemes the electric field generated by a low energy high current beam is used to accelerate a low current second beam to high energies. The two beams can be traveling in separate cavity structures, and the field is transmitted from one cavity to the other through couplers. Or, the two beams can be traveling in the same cavity. In either case the ratio of the electric fields on the two beam trajectories must be very large. This is equivalent to having a large transformer ratio in a voltage step-up transformer. Experiments are being carried out at DESY (single cavity wakefield accelerator), and at LBL and LLNL (dual cavity two-beam accelerator). In addition, several other non-laser schemes were proposed and discussed at the workshop, but more careful and more extensive analyses are needed for these schemes. Abstracts of individual items from the conference were prepared separately for the data base. (GHT)

**46990 (CONF-850470—9) Tests of compressed geometry NEC acceleration tubes.** Raatz, J.E.; Rathmell, R.D.; Stelson, P.H.; Ziegler, N.F. (National Electrostatics Corp., Middleton, WI (USA); Oak Ridge National Lab., TN (USA)). 1985. Contract AC05-84OR21400. 12p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016392.

From 4. international conference on electrostatic accelerator technology and associated boosters; Buenos Aires, Argentina (15 Apr 1985).

Tests have been performed in the 3 MV Pelletron test machine at NEC on a compressed geometry tube which increases the insulating length of the tube by eliminating the heated electrode assemblies (~2.5 cm thick) at the end of each tube section. Some insert electrodes are changed to provide some trapping of secondary ions. The geometry tested provided an 18% increase in live ceramic in the tube. The compressed geometry tube allowed a terminal voltage of 3.55 MV on the 3 MV column at normal gradients of 30.3 kv/tube gap. The tube was also conditioned to more than 4 MV and remained stable in voltage with few sparks and with low x-ray levels for days at about 4 MV. This same performance could be achieved with or without arc discharge cleaning. 4 refs., 4 figs.

**46991 (CONF-850470—10) Hydrogen arc discharge cleaning of accelerator tubes.** Stelson, P.H.; Raatz, J.R.; Rathmell, R.D. (Oak Ridge National Lab., TN (USA); National Electrostatics Corp., Middleton, WI (USA)). 1985. Contract AC05-84OR21400. 6p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016393.

From 4. international conference on electrostatic accelerator technology and associated boosters; Buenos Aires, Argentina (15 Apr 1985).

Accelerator tubes manufactured by NEC were cleaned by the hydrogen arc discharge method and tested on the NEC 3-MV test accelerator. We will discuss the results of this testing program. Generally, we confirm the favorable experience previously obtained by Korschinek, et al. The familiar micro-discharge exhibited by normal tubes are largely elminated in arc discharge cleaned tubes. Thus, the arc discharge process has the same observable effect as voltage conditioning. This result suggests that the hydrogen discharge is effective in removing carbon and hydrocarbons from the surface of the accelerator tube. 2 refs.

**46992 (CONF-8504152—5) How to work with RHIC (Really Highly Interesting Collider).** Young, G.R. (Oak Ridge National Lab., TN (USA)). 1985. Contract AC05-84OR21400. 21p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016471.

From Workshop on experiments for RHIC; Upton, NY, USA (15 Apr 1985).

Some issues pertinent to the design of collider rings for relativistic heavy ions are presented. Experiments at such facilities are felt to offer the best chance for creating in the laboratory a new phase of subatomic matter, the quark-gluon plasma. It appears possible to design a machine with sufficient luminosity, even for the heaviest nuclei in nature, to allow a thorough exploration of the production conditions and decay characteristics of quark-gluon plasma. Specific features of the proposed Relativistic Heavy-Ion Collider (RHIC) at BNL are discussed with an eye toward implications for experiment.

**46993 (DOE/ER/40124—5) University of Washington superconducting booster linac.** Storm, D.W.; Amsbaugh, J.F.; Cramer, J.G.; Swanson, H.E.; Trainor, T.A.; Vandenbosch, R.; Weitkamp, W.G.; Will, D.I. (Washington Univ., Seattle (USA). Nuclear Physics Lab.). 1985. Contract AC06-84ER40124. 4p. (CONF-850504—272). NTIS, PC A02/MF A01; GPO Dep. File Number DE85017418.

From Particle accelerator conference; Vancouver, Canada (13 May 1985).

We have begun construction of a superconducting linac designed to accelerate ions from protons through about mass 60. Injected by our 9 MV-terminal tandem van de Graaff accelerator, the linac is expected to double the proton energy and quadruple the energies of heavier ions. The resonators are lead plated copper quarter wave structures. The overall layout and expected performance of the accelerator will be presented, along with a brief status report. 3 refs., 3 figs.

**46994 (DOE/ER/40124—6) Superconducting resonators for the University of Washington booster linac.** Storm, D.W.; Brennan, J.M.; Ben-Zvi, I. (Washington Univ., Seattle (USA). Nuclear Physics Lab.; State Univ. of New York, Stony Brook (USA); Weizmann Inst. of Science, Rehovoth (Israel). Dept. of Nuclear Physics). 1985. Contract AC06-84ER40124. 4p. (CONF-850504—271). NTIS, PC A02/MF A01; GPO Dep. File Number DE85017419.

From Particle accelerator conference; Vancouver, Canada (13 May 1985).

We have developed two models of a 150 MHz quarter wave resonator - one with optimum beta = 0.10 and one with optimum beta = 0.21. These are lead-plated copper structures. The prototype beta = 0.10 resonator was tested successfully a year ago and gave average accelerating fields of 3.5 MV/m with 4.2 watts dissipated. It is quite similar to the resonator developed by the second and third authors. We have made and tested several more of this model. A prototype beta = 0.21 resonator has been completed, but weld flaws have prevented definitive tests. In order to minimize surface electric fields in the high-beta resonator, there were some modifications in the drift tube shape beyond those required to change the optimum beta. These quarter wave resonators have a wide transit time factor curve and are extremely rigid mechanically. Variations in eigen-frequency due to mechanical vibrations are less than 1 Hertz. Maximum attainable fields are limited by field emission. 2 refs., 3 figs.

46995 **(FNAL-TM—1329) Fermilab Tevatron high level rf accelerating systems.** Kerns, Q.; Kerns, C.; Miller, H.; Tawser, S.; Reid, J.; Webber, R.; Wildman, D. (Fermi National Accelerator Lab., Batavia, IL (USA)). Jun 1985. Contract AC02-76CH03000. 4p. (CONF-850504—264). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85017445.

From Particle accelerator conference; Vancouver, Canada (13 May 1985).

Eight tuned rf cavities have been installed and operated in the F0 straight section of the Tevatron. Their mechanical placement along the beam line enables them to be operated for colliding beams as two independent groups of four cavities, group 1-4 accelerating antiprotons and group 5-8 accelerating protons. The only difference is that the spacing between cavities 4 and 5 was increased to stay clear of the F0 colliding point. The cavities can easily be rephased by switching cables in a low-level distribution system (fan-out) so that the full accelerating capability of all eight cavities can be used during fixed target operations. Likewise, the cables from capacitive probes on each cavity gap can be switched to proper lengths and summed in a fan-back system to give an rf signal representing the amplitude and phase as "seen by the beam," separately for protons and antiprotons. Such signals have been used to phase lock the Tevatron to the Main Ring for synchronous transfer.

46996 **(FNAL-TM—1330) Measuring the orbit length of the Tevatron.** Kerns, C.; Kerns, Q.; Miller, H. (Fermi National Accelerator Lab., Batavia, IL (USA)). Jun 1985. Contract AC02-76CH03000. 4p. (CONF-850504—268). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85017443.

From Particle accelerator conference; Vancouver, Canada (13 May 1985).

The orbit length in the Tevatron was measured when coasting beam was first obtained. The method was time-of-flight, using a vernier phase comparison between beam pickup signals and a synthesizer sine wave. Some effort was spent making a stable phase detector so that it would not be a limiting factor. The results exhibited a repeatability of a few Hz at 53 MHz, corresponding to a mean radius measurement to 0.1 mm. 5 refs., 4 figs.

46997 **(FRNC-TH—1926) Design of a self-focusing linear electron accelerator.** Hddab, S. (Paris-6 Univ., 75 (France)). Jun 1983. 212p. (In French). NTIS (US Sales Only), PC A10/MF A01. File Number DE85752177.

In this report we tackle the principal physical and technical problems related to the design of a self-focusing linear electron accelerator. The study of the dynamic phenomena occurring at the entrance to the first resonant cell allows us, by an adequate choice of the longitudinal height of this cell, to avoid the use of an external magnetic focusing coil. Optimization of the ultra high frequency properties of the resonant structure has been achieved by polishing the internal surfaces of the cavities, by adapting a new brazing technique and optimizing the geometry of the cells. A simulation code has been adapted to an interactive use on microcomputer.

46998 (INIS-mf—9351, pp 712-724) **Future accelerators and experimental facilities at GSI.** Kienle, P. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)). 1984. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781594. (CONF-8409143—).

From 7. international conference on atomic masses and fundamental constants (AMCO-7); Darmstadt-Seeheim, F.R. Germany (3 Sep 1984).

During the last years GSI developed plans for future accelerators and experimental facilities with the intention to extend heavy ion research in a wide scope to higher energies and into new fields of research using novel techniques for acceleration, accumulation, storage and phase space density increase of heavy ion beams up to $^{238}U$. The prime goals of this development plan using as a first step a synchrotron acceleration ring connected with an accumulator-, storage-, cooling- and experimental ring are the following: 1. Provide completely stripped heavy ion beams up to $U^{92+}$ with the highest possible phase space densities using various cooling techniques in a storage ring. 2. Provide radioactive heavy ion beams by accumulation, storage and cooling of fragmentation or fission products from beams of the synchrotron. 3. Provide facilities for internal target experiments using simultaneously cooled circulating beams. 4. Provide two merging beams in the storage ring with well defineable collision energies up to the Coulomb barrier of the heaviest ion like $U^{92+}$ in order to study atomic collision processes in high Coulomb fields with both nuclei highly ionized. 5. Provide a beam of heavy ions up to $U^{92+}$ with best phase space density for further acceleration and collisions in superconducting collider rings at very high c.m. energies (20 GeV/u) and as high as possible luminosities. (orig.).

46999 (INIS-SU—284, pp 27-29) **Design of an ion accelerator for the national economy.** Val'dner, O.A.; Gass, V.F.; Glazkov, A.A.; Kolyaskin, A.D.; Leonov, V.N.; Lobanov, N.R. (Moskovskij Gosudarstvennyj Univ. (USSR)). 1983. (In Russian). NTIS (US Sales Only), PC A05/MF A01. File Number DE85781488. (CONF-8306180—No.3(15)).

From 8. All-union seminar on linear accelerators; Kharkov, Ukrainian SSR (1 Jun 1983).

Results of investigations into a small-size 3 MeV linear resonator deutron accelerator are presented. The design of the cavity resonator and sectional vacuum housing are described. A general schematic diagram of the accelerator is given and its certain elements are described. Dynamics of deutrons is investigated and parameters of the flight path channel are determined. Basic calculated characteristics of the accelerator are given. Problems of the deutron output energy control are considered.

47000 (INIS-SU—302, pp 363-368) **KUTI-20 heavy ion collective accelerator.** Sarantsev, V.P. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1983. (In Russian). NTIS (US Sales Only), PC A19/MF A01. File Number DE85781610. (CONF-8210133—Vol.2).

From 8. All-Union conference on the charged particle accelerators; Protvino, USSR (19 Oct 1982).

Construction of the KUTI-20 heavy ion accelerator, designed for ion acceleration up to uranium, has been started in JINR. Functional circuit of the KUTI-20 and its major parameters are given. The KUTI-20 is mainly intended for the operation as a heavy-ion synchrotron (HIS) injector. Injection energy of 20 MeV/nucleon is selected for the KUTI-20. The pulse repetition rate is 50 Hz. It permits to use the KUTI-20 during the HIS operation as an independent accelerator for nuclear-physical researches and other applied purposes.

47001 **(INIS-SU—302) 8. All-union conference on charged particle accelerators. Vol. 2. Proceedings.** (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow; United Nuclear Corp., New Haven, CT (USA)). 1983. 430p. (In Russian). (CONF-8210133—Vol.2). NTIS (US Sales Only), PC A19/MF A01. File Number DE85781610.

From 8. All-Union conference on the charged particle accelerators; Protvino, USSR (19 Oct 1982).

Abstracts of individual items from the conference were prepared separately for the data base. (GHT)

47002 (KMU-HEP—84-08, pp 69-76) **Status and prospects of the Novosibirsk electron-positron storage ring VEPP-4.** Zholents, A.A. (AN SSSR, Novosibirsk. Inst. Yadernoj Fiziki). Jun 1984. NTIS (US Sales Only), PC A06/MF A01. File Number DE85781587. (CONF-8403194—).

From 15. spring symposium on high energy physics; Georgenthal, German D.R. (26 Mar 1984).

The Novosibirsk storage ring VEPP-4 has been designed for experiments with electron-positron colliding beams. The scheme of the whole complex is shown. The VEPP-4 works actually at an energy of about 4.7 GeV (projected 7 MeV). Beam envelopes and parameters of the central interaction point (two additionally lateral ones are planned) are given. The characteristics of the magnetic detector MD-1 are outlined and the suggestion is made to replace the set of coordinate proportional chambers by drift ones in order to improve the detection efficiency for the two-photon events by a factor of 1.5 to 3. Finally results of experiments on measuring elementary particle masses (two UPSILON and three PSI resonances) are given in comparison to world average data.

47003 **(LA-UR—85-2352) LAMPF II capabilities from an experimenter's viewpoint.** Macek, R.J. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 35p. (CONF-8504169—1). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85015676.

From Workshop on nuclear and particle physics at intermediate energies with hadrons (ICTP); Trieste, Italy (1 Apr 1985).

LAMPF II has been proposed to extend the intensity frontier of nuclear and particle physics from about 1 GeV to 45 GeV. It is reviewed here with emphasis on capabilities of the experimental facilities. Major accelerator features, costs, and the choice of energy and current are also discussed. 5 refs., 16 figs.

47004 **(LBL—18966) Compact heavy ion RFQ preaccelerator for use at the CERN Linac I.** Gough, R.A.; Staples, J.; Caylor, R.; Howard, D.; MacGill, R.; Tanabe, J. (Lawrence Berkeley Lab., CA (USA)). May 1985. Contract AC03-76SF00098. 6p. (CONF-850504—277). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85017643.

From Particle accelerator conference; Vancouver, Canada (13 May 1985).

This paper describes the LBL contribution to a project designed to provide fully-stripped oxygen beams for acceleration in the CERN PS complex. A preaccelerator for Linac I, consisting of an ECR ion source, an RFQ linac, and rf matching cavities, is being assembled as part of a collaborative arrangement among LBL, GSI, and CERN. The RFQ, designed and built at LBL, will accept analyzed oxygen +6 beam from the ECR at 5.6 keV/amu, and accelerate it to 139.5 keV/amu, the injection energy required for 2 $\beta\lambda$ operation of Linac I. Stripping to +8 will be done with a foil stripper at 12.5 MeV/amu at the exit of Linac I. The RFQ operates at 202.56 MHz and is 0.86 meters in length. The structure is stabilized with vane coupling rings, and uses a single drive loop and a single tuning loop. 5 refs., 3 figs.

47005 **(LBL—19903) Recent advances in the technology of superconducting accelerator magnets.** Taylor, C.E. (Lawrence Berkeley Lab., CA (USA)). May 1985. Contract AC03-76SF00098. 5p. (CONF-850504—273). NTIS, PC A02/MF A01; GPO Dep. File Number DE85017649.

From Particle accelerator conference; Vancouver, Canada (13 May 1985).

Recent progress in technology of high-current-density cables for SSC model magnets is summarized. NbTi cable with J/sub c/ up to 50% higher than Tevatron cable can be expected. Magnetization effects can be predicted and corrected with several new techniques. Development of Superconductor with 2 to 3 $\mu$m filament diameter and high J/sub c/ is expected. 15 refs., 3 figs.

47006 **(TRITA-EPP—84-11) Short pulse acceleration in a racetrack microtron.** Rosander, S. (Royal Inst. of Tech., Stockholm (Sweden). Dept. of Electron and Plasma Physics). Nov 1984. 10p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85702154.

Electron pulses of a duration much shorter than the time constant of linear accelerator have been accelerated in a racetrack microtron (RTM). As the pulses are short, part of the RF energy sorted in the linac may be utilized so that the instantaneous beam power can well exceed the RF drive.

47007 **Electrostatic wire for stabilizing a charged particle beam.** Prono, D. S.; Briggs, R. J.; Caporaso, G. J. (to The United States of America as represented by the United States Department of Energy). US Patent 4,507,614. 26 Mar 1985. Filed date 21 Mar 1983. vp.

PAT-APPL-477458.

In combination with a charged particle beam generator and accelerator, apparatus and method are provided for stabilizing a beam of electrically charged particles. A guiding means, disposed within the particle beam, has an electric charge induced upon it by the charged particle beam. Because the sign of the electric charge on the guiding means and the sign of the particle beam are opposite, the particles are attracted toward and cluster around the guiding means to thereby stabilize the particle beam as it travels.

## 4302 Beam Dynamics, Field Calculations, And Ion Optics

*REFER ALSO TO CITATION(S) 47024*

47008 **(CERN-EP—85-56) Review of electron cooling experiments.** Poth, H. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Kernphysik). 29 Apr 1985. 27p. (CONF-8409171—4). NTIS (US Sales Only), PC A03/MF A01. File Number DE85901952.

From Workshop on electron cooling; Karlsruhe, F.R. Germany (22 Sep 1984).

The principal results of electron cooling experiments in Novosibirsk, CERN, and Fermilab will be reviewed. In these three laboratories cooling experiments were performed with stored protons at 1.5, 35, 46, 65, 85, 114, and 200 MeV. Transverse and longitudinal cooling times were measured under various conditions, and equilibrium beam properties were determined. The cooling of coasting and bunched beams was studied, and the stacking and accumulation of successive proton pulses were attempted. 16 refs., 10 figs.

47009 **(CONF-830911—40) Relativistic fluid equations of motion, equilibrium and stability of beams.** Siambis, J.G. (Lockheed Palo Alto Research Labs., CA (USA)). 1983. Contract W-7405-ENG-48. 12p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016502.

From 5. international conference on high power particle beams; San Francisco, CA, USA (12 Sep 1983).

A general relativistic fluid formulation has been obtained by Siambis. The set of relativistic fluid equations includes a general equation of state. The use of these equations, however, is hampered by the presence of additional fluid variables resulting from relativistic corrections. The systematic expansion and associated nice variables introduced by Newcomb, have been utilized in the formulation of Siambis to yield a compact set of relativistic fluid equations which is the relativistic generalization of the well-known non-relativistic set of fluid equations. Specifically a general relativistic equation of state is obtained, which can be reduced to much simpler forms for specific cases. Equilibrium constraints are obtained and discussed. A stability analysis has been carried out for the two-stream instability including relativistic thermal corrections. A new mode of beam oscillation has been found, the thermal-relativistic mode. This mode is a fast-wave mode and it interacts resonantly, under certain conditions, with the well-known positive energy beam fast wave. 5 refs., 2 figs.

47010 **(FNAL-TM—1324) Statistics of dipole steering in the tevatron.** Syphers, M.J. (Fermi National Accelerator Lab., Batavia, IL (USA)). Jun 1985. Contract AC02-76CH03000. 4p. (CONF-850504—265). NTIS, PC A02/MF A01; GPO Dep. File Number DE85017438.

From Particle accelerator conference; Vancouver, Canada (13 May 1985).

Methods of calculating the expected rms orbit distortion and the expected peak orbit distortion for a large FODO synchrotron are described. An expression for the expected rms correction element dipole strength necessary to correct the closed orbit of a large FODO synchrotron is derived. The uncorrected closed orbit of the FNAL Tevatron accelerator is determined from beam position data and operational settings of the correction element dipole magnets. The uncorrected orbit and correction element dipole strengths are compared to the results of the Tevatron design study. Use of these expressions for SSC lattices is discussed.

47011 **(FNAL-TM—1326) Programmable high power beam damper for the Tevatron.** Crisp, J.; Goodwin, R.; Gerig, R.; Johnson, M.; Jones, A.; Kerns, C.; Kerns, Q.; Lucas, P.; Martin, D.; Miller, H. (Fermi National Accelerator Lab., Batavia, IL (USA)). Jun 1985. Contract AC02-76CH03000. 4p. (CONF-850504—270). NTIS, PC A02/MF A01; GPO Dep. File Number DE85017441.

From Particle accelerator conference; Vancouver, Canada (13 May 1985).

A bunch-by-bunch beam damper has been developed for the Fermilab Tevatron. The system reduces betatron oscillation ampli-

tudes and incorporates some useful machine diagnostics. The device is programmable via look-up tables so the output is an arbitrary function, on a bunch-by-bunch basis, of the beam displacement. We are presently using this feature to measure the betatron tune throughout the acceleration cycle. 4 refs.

47012 **(FNAL-TM—1328) Tevatron global radius and 0s system.** Bristol, S.; Kerns, C.; Kerns, Q.; Miller, H.W. (Fermi National Accelerator Lab., Batavia, IL (USA)). Jun 1985. Contract AC02-76CH03000. 4p. (CONF-850504—269). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85017442.

From Particle accelerator conference; Vancouver, Canada (13 May 1985).

It has been found to be practical to extract a turn-average measurement of bunch beam phase relative to cavity gap voltage. This 0s signal shows the bunch position on the rf wave throughout injection, acceleration and extraction, including coherent synchrotron oscillations when present. In turn, the time derivative of 0s is a direct measure of global radial position error. We use the 0s signal, driving a phase shifter in the rf low-level system, to damp coherent synchrotron oscillations. Design and operation will be discussed including single beam bunch operation if available. 8 refs., 5 figs.

47013 **(FNAL-TM—1338) Linear aperture criteria for a standard cell lattice.** Gelfand, N.M. (Fermi National Accelerator Lab., Batavia, IL (USA)). Jul 1985. Contract AC02-76CH03000. 13p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85017365.

Among the parameters which need to be specified in the design of the SSC are the cell length (l/sub c/) and the coil diameter (d/sub c/). The quality of the magnetic field of the bending magnets, reflected in both small multipole coefficients and a small sigma for these coefficients, improve as d/sub c/ increases. Similarly the smaller $\beta$ resulting from a decreased l/sub c/ results in an increased admittance (for a constant size beam pipe). Unfortunately increasing d/sub c/ and/or l/sub c/ would result in increasing the cost of the SSC. It is not only desirable but necessary to understand how the performance of an accelerator depends on d/sub c/ and l/sub c/ so that we can have confidence that the SSC when built will work. It should be straightforward to know whether or not an accelerator, once built, works or not. There are however no well accepted tools or criteria for deciding whether or not a proposed design of an accelerator will provide acceptable performance. This is particularly so in the case of accelerators built of superconducting magnets in which the magnetic field is determined by the current distribution in the coils. 3 figs.

47014 **(FNAL-TM—1339) Impedances of the shielded bellows in the SSC and the effects on beam stability.** Ng, K.Y. (Fermi National Accelerator Lab., Batavia, IL (USA)). Jul 1985. Contract AC02-76CH03000. 18p. NTIS, PC A02. File Number DE85017364.

The 1.08 km of bellows in Design A of the SSC will contribute to single-bunch instabilities: transverse mode-coupling, transverse microwave (for broad band at 13 GHz), and longitudinal microwave. The effectiveness of shielded bellows is considered. (GHT)

47015 **(FNAL-TM—1340) Estimate of the contributions of bellows to the impedances and beam instabilities of the SSC.** Bisognano, J.; Ng, K.Y. (Fermi National Accelerator Lab., Batavia, IL (USA); Lawrence Berkeley Lab., CA (USA)). Jul 1985. Contract AC03-76SF00098;AC02-76CH03000. 17p. NTIS, PC A02. File Number DE85017363.

Between sections of the vacuum chamber, bellows are needed to compensate for thermal expansion and transverse offsets. For beampipe made of stainless steel with a coefficient of linear expansion 19 x $10^{-6}$/°C and a temperature variation of ~316°C, the allowance for bellows is ~1.2% of the total length of the beampipe, if we assume that the bellows are 50% compressible. This implies 1.08 km of bellows for Design A of the SSC which has a circumference of 90 km. Such a length of bellows will certainly contribute to the longitudinal and transverse impedances of the accelerator and will therefore affect the stability of the beam. In the Reference Designs, the actual impedances of the bellows have not been calculated; only an allowance of Z/sub parallel//n = 0.05 Ω and Z/sub perpendicular/ = 7 MΩ/m is made for miscellaneous discontinuities because all the bellows and pumping ports are assumed totally shielded. It is the purpose of this article to examine the actual contributions by the bellows to the longitudinal and transverse impedances assuming that they are not shielded.

47016 **(IFVE-OI—84-16) Methodical errors in tuning accelerating structures of quadrupole HF focusing using the perturbation method.** Barsukov, A.B.; Belyaev, O.K.; Igoshin, V.B. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1984. 12p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE85702155.

This paper gives the analysis of methodical errors in tuning the accelerating structures with RF quadrupole focusing using the perturbation method. These methodical errors are caused by nonhomogeneous geometry of the accelerating channel and displacement of perturbation body from its axis. The formula for calculating the form factor for metal sphere in nonuniform e ternal field of an arbitrary configuration has been deduced. The estimation of maximum error for spatial-uniform quadrupole accelerating channel is given.

47017 (INIS-SU—302, pp 357-362) **Ion collective acceleration and high current beam transport.** Kolomenskij, A.A. (AN SSSR, Moscow. Fizicheskij Inst.). 1983. (In Russian). NTIS (US Sales Only), PC A19/MF A01. File Number DE85781610. (CONF-8210133—Vol.2).

From 8. All-Union conference on the charged particle accelerators; Protvino, USSR (19 Oct 1982).

Results of investigation of high-current beam (HCB) transport in vacuum channels with dielectric walls (VCDW) are presented. It is shown, that HCB transport can be realized not only in rectilinear dielectric channels, but also in curvili also in curvilitear oges. In particular, it proved to be possible to bend the beam with parameters 50 kA, 400 keV by 90 deg. A problem of negative ion intense beam production is considered. It is shown, that in magnetic insulation diodes hydrogen ion currents of about several kA are obtained at current densities 10 A/cm$^2$. Results of collective ion acceleration in VCDW are given. Two regions with different physical mechanisms of ion acceleration should be distinguished. In the first region ("plasma"), corresponding to HCB motion in VCDW ion generation and their acceleration in quasipotential field of HCB up to the energy of the order of electrons or less takes place. In the second region ("beam"), corresponding to joint motion of "extracted" ions and HCB electrons, ion acceleration takes place in the fields of waves, which can be excited due to the mechanism of two-beam instability type. Considerable contribution can also be made by stochastic mechanism of ion acceleration.

47018 (INIS-SU—302, pp 369-371) **Ion dynamics in the field of a slow cyclotron wave of a hollow electron beam.** Kapchinskij, M.I.; Onishchenko, I.N.; Panchenko, I.P. (AN Ukrainskoj SSR, Kharkov. Fiziko-Tekhnicheskij Inst.). 1983. (In Russian). NTIS (US Sales Only), PC A19/MF A01. File Number DE85781610. (CONF-8210133—Vol.2).

From 8. All-Union conference on the charged particle accelerators; Protvino, USSR (19 Oct 1982).

To realize autoresonance acceleration method the two-dimensional dynamics of ions in the field of a slow cyclotron wave is investigated numerically. It is shown, that generate coefficient of ion capture in the autoresonance accelerator with a hallow electron beam exceeds 50%. In can be considerably increased so that it reaches 1 by means of introduction into ion injector of a bunching section and its synchronization with a HF generator, exciting cyclotron wave in electron beam so that the injection takes place only in the range of phases $0 <= \text{phi} <= \pi$.

47019 **(JINR—9-84-522) Effect of magnet and lense characteristics spread on particle trajectory parameters in the SPIN installation.** Borisovskaya, Z.V.; Zhidkov, E.P.; Smirnova, L.A.; Shelaev, I.A.; Yudin, I.P. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation). 1984. 6p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE85702156.

The effect of spread of dipole magnet effective length, of effective length and gradient of quadrupole lenses in regular cells and matched straight insertions of the 1.5 GeV proton superconducting model synchrotron on the transverse beam size and calculation frequency of betatron oscillations is investigated. Calculations of closed orbits and their parameters were performed taking into account the measured effective lengths, fields and magnet element mounting over the ring. A possibility of beam parameter operation control is shown in the linear approximation under the condition of separate power supply of magnet system elements (dipole magnets, focusing, defocusing lenses of regular cells, and of F and D lenses of matched straight insertions).

47020 **(LBL—19528) Power combiners/dividers for loop pickup and kicker arrays for FNAL stochastic cooling rings.** Johnson, J.K.; Nemetz, R. (Lawrence Berkeley Lab., CA (USA)). May 1985. Contract AC03-76SF00098. 6p. (CONF-850504—256). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85016562.

From Particle accelerator conference; Vancouver, Canada (13 May 1985).

The anti-proton accumulator and debuncher at FNAL will use stochastic methods to "cool" the beam. Pairs of quarter-wavelength directional-coupler loops are used to detect and kick the beam. The loops are copper plates which are flush with the upper and lower wall of a rectangular beam pipe. The plates, when surrounded by a properly sized pocket, form a 100-ohm transmission-line directional coupler. As the beam passes, a signal which gives position and time information, is induced in the plates. But, because the signal levels are low (<.5 picowatts per pair), a power combiner (usually several primary combiners feeding a secondary combiner) is used to combine the outputs of many loops. Subsequently, the combined signal is amplified, filtered and then fed into a divider, (that is, a combiner operating in reverse). The divider distributes the signal into a different set of loops which modify (kick) the beam's position. Since the loop couplers are arranged linearly, in arrays of various lengths, combiners also provide a convenient method of reducing the number of vacuum feedthroughs and preamplifiers and their related costs in performance and dollars. In this note we describe various stripline combiner systems that add the outputs of 4, 8, 16 or 32 loops.

47021 **(LBL—19797) Hamiltonian systems in accelerator physics.** Laslett, L.J. (Lawrence Berkeley Lab., CA (USA)). Jun 1985. Contract AC03-76SF00098. 15p. (CONF-8503105—8). NTIS, PC A02/MF A01; GPO Dep. File Number DE85016565.

From Orbital dynamics and applications to accelerators workshop; Berkeley, CA, USA (7 Mar 1985).

General features of the design of annular particle accelerators or storage rings are outlined and the Hamiltonian character of individual-ion motion is indicated. Examples of phase plots are presented, for the motion in one spatial degree of freedom, of an ion subject to a periodic nonlinear focusing force. A canonical transformation describing coupled nonlinear motion also is given, and alternative types of graphical display are suggested for the investigation of long-term stability in such cases. 7 figs.

47022 **(LBL—19809) High current beam transport with multiple beam arrays.** Kim, C.H. (Lawrence Berkeley Lab., CA (USA)). May 1985. Contract AC03-76SF00098. 18p. (CONF-8505164—7). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85016557.

From Workshop on high brightness, high current, high duty factor ion injectors; San Diego, CA, USA (21 May 1985).

Highlights of recent experimental and theoretical research progress on the high current beam transport of single and multiple beams by the Heavy Ion Fusion Accelerator Research (HIFAR) group at the Lawrence Berkeley Laboratory (LBL) are presented. In the single beam transport experiment (SBTE), stability boundaries and the emittance growth of a space charge dominated beam in a long quadrupole transport channel were measured and compared with theory and computer simulations. Also, a multiple beam ion induction linac (MBE-4) is being constructed at LBL which will permit study of multiple beam transport arrays, and acceleration and bunch length compression of individually focused beamlets. Various design considerations of MBE-4 regarding scaling laws, nonlinear effects, misalignments, and transverse and longitudinal space charge effects are summarized. Some aspects of longitudinal beam dynamics including schemes to generate the accelerating voltage waveforms and to amplify beam current are also discussed.

47023 **(UCRL—92531) Electromagnetic "particle-in-cell" plasma simulation.** Langdon, A.B. (Lawrence Livermore National Lab., CA (USA)). 22 Apr 1985. Contract W-7405-ENG-48. 5p. (CONF-8503105—9). NTIS, PC A02/MF A01; GPO Dep. File Number DE85013223.

From Orbital dynamics and applications to accelerators workshop; Berkeley, CA, USA (7 Mar 1985).

"PIC" simulation tracks particles through electromagnetic fields calculated self-consistently from the charge and current densities of the particles themselves, external sources, and boundaries. Already used extensively in plasma physics, such simulations have become useful in the design of accelerators and their r.f. sources. 5 refs.

## 4303 Auxiliaries And Components

*REFER ALSO TO CITATION(S) 47004, 47057*

47024 **(CONF-8406133—18) Relativistic fluid formulation and theory of intense relativistic electron beams.** Siambis, J.G. (Lockheed Missiles and Space Co., Palo Alto, CA (USA)). 1984. Contract W-7405-ENG-48. 4p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016133.

From DARPA propagation meeting; Monterey, CA, USA (18 Jun 1984).

A new general relativistic fluid formulation has been obtained for intense relativistic electron beams (IREB) with arbitrarily high relativistic mass factor $\gamma$. This theory is valid for confined IREB equilibria such as those found inside high energy accelerators as well as in the pinched and ion-focused regimes of beam propagation in plasma channels. The new relativistic fluid formulation is based on the covariant relativistic fluid formulation of Newcomb with the parameter $\lambda$ identical to 1, in order to allow for realistic confined equilibria. The resulting equilibrium constraints require that the beam has a slow rotational velocity around its direction of propagation and that the off-diagonal thermal stress element, associated with these two directions of motion, be nonzero. The effective betatron oscillation frequency of the fluid elements of the beam is modified by the radial gradient and anisotropies in the thermal stress elements of the beam fluid. The wave equation, for sausage, hose and filamentation excitations on the relativistic fluid beam, is found to be formally identical to that obtained from the Vlasov equation approach, hence phase-mixing damping is a generic and self-consistent correlate of the new relativistic fluid formulation.

47025 **(FNAL-TM—1314) Operation of large cryogenic systems.** Rode, C.H.; Ferry, B.; Fowler, W.B.; Makara, J.; Peterson, T.; Theilacker, J.; Walker, R. (Fermi National Accelerator Lab., Batavia, IL (USA)). Jun 1985. Contract AC02-76CH03000. 6p. (CONF-850504—267). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85017439.

From Particle accelerator conference; Vancouver, Canada (13 May 1985).

This report is based on the past 12 years of experiments on R & D and operation of the 27 kW Fermilab Tevatron Cryogenic System. In general the comments are applicable for all helium plants larger than 1000W (400 l/hr) and non mass-produced nitrogen plants larger than 50 tons per day. 14 refs., 3 figs., 1 tab.

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47026 **(FNAL-TM—1325) Proposals for synchrotron light sources.** Teng, L.C. (Fermi National Accelerator Lab., Batavia, IL (USA)). Jun 1985. Contract AC02-76CH03000. 6p. (CONF-850504—263). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85017444.

From Particle accelerator conference; Vancouver, Canada (13 May 1985).

Ever since it was first applied in the 1960's synchrotron radiation from an accelerating electron beam has been gaining popularity as a powerful tool for research and development in a wide variety of fields of science and technology. By now there are some 20 facilities operating either parasitically or dedicatedly for synchrotron radiation research in different parts of the world. In addition there are another 20 facilities either in construction or in various stages of proposal and design. The experiences gained from the operating facilities and the recent development of insertion devices such as wigglers and undulators as radiation sources led to a new set of requirements on the design of synchrotron radiation storage rings for optimum utility. The surprisingly uniform applicability and unanimous acceptance of these criteria give assurance that they are indeed valid criteria derived form mature considerations and experiences. Instead of describing the design of each of these new facilities it is, thus, more effective to discuss these desirable design features and indicate how they are incorporated in the design using machines listed as examples. 9 refs., 7 figs., 2 tabs.

47027 **(FNAL-TM—1327) Low level rf system for the Fermilab Tevatron.** Meisner, K.; Edwards, H.; Fitzgerald, J.; Kerns, Q. (Fermi National Accelerator Lab., Batavia, IL (USA)). Jun 1985. Contract AC02-76CH03000. 4p. (CONF-850504—266). NTIS, PC A02/MF A01; GPO Dep. File Number DE85017440.

From Particle accelerator conference; Vancouver, Canada (13 May 1985).

This paper discusses the design philosophy, hardware, and operation of the Fermilab Tevatron low level rf system. Plans to extend the system for colliding beams physics are also presented.

47028 **(FNAL-TM—1341) Investigation of the skin depth effect of a metallic coating on a ceramic beampipe inside a kicker.** Ng, K.Y. (Fermi National Accelerator Lab., Batavia, IL (USA)). Jul 1985. Contract AC02-76CH03000. 17p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85017362.

Inside a kicker magnet, metallic beampipe cannot be used because it will screen off the rapid rising of the kicker's magnetic field. When a ceramic beampipe is used, one usually coats the inside with a thin layer of metal so as to carry at least part of the beam's image current and to prevent static charge buildup. The purpose of this article is to investigate whether such a coating will alter the risetime constant of the magnetic field significantly, whether such a coating can withstand the strong transient current induced by the fast rising magnetic field, and whether the back magnetic field generated by this transient current is strong enough to upset the designed risetime of the kicker.

47029 (GSI—85-10, pp 181-186) **GANIL exotic beam developments.** Dufour, J.P. Mar 1985. B. File Number DE85752251. (CONF-8410210—).

From 7. high energy heavy ion study conference; Darmstadt, F.R. Germany (8 Oct 1984).

The availability at GANIL of high intensity, high resolution heavy ion beams in the intermediate energy range called for the development of new experimental facilities well adapted to the associated reaction mechanisms. At such energies the stripping is a dominant phenomenon, in atomic physics one may produce hydrogen or helium like ions through the electronic stripping process, in nuclear physics the projectile fragmentation follows from a similar nucleonic stripping. In both cases the secondary fragments have a velocity very close in value and direction to that of the beam. The LISE facility (Ligne d'Ions Super-Epluches: super-stripped ions beam line) has thus been built to cover the needs for both atomic and nuclear physics experiments.

47030 (GSI—85-10, pp 329-345) **Experiments with light ions at the CERN super proton synchrotron.** Pugh, H.G. Mar 1985. B. File Number DE85752251. (CONF-8410210—).

From 7. high energy heavy ion study conference; Darmstadt, F.R. Germany (8 Oct 1984).

The CERN-GSI-LBL plan to install an injector for light ions at the CERN SPS is reviewed, and an outline is given of the experiments so far approved by CERN for 50 A GeV and 225 A GeV running in 1986-87.

47031 (INIS-mf—9351, pp 696-701) **LISE: A new spectrometer at GANIL for physics on exotic nuclei (C.E.N.B.G. Bordeaux - I.P.N. Orsay - GANIL).** Mueller, A.C. (Grand Accelerateur National d'Ions Lourds (GANIL), 14 - Caen (France)). 1984. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781594. (CONF-8409143—).

From 7. international conference on atomic masses and fundamental constants (AMCO-7); Darmstadt-Seeheim, F.R. Germany (3 Sep 1984).

Little additional stripping is required in order to produce fully "naked" or hydrogen- and helium-like heavy species which are of great actual interest in atomic physics. This gave origin to the project "LISE", a special beam-line, consisting of a stripper and a magnetic analyser in order to produce and to separate the high-charge states and to provide them in the form of beams of high optical quality. From the beginning it was also specified that this instrument, with some additional adaptations would serve as well for physics on nuclei far from stability.

47032 (INIS-SU—302, pp 352-354) **Multichannel fiber-optical communication lines for ion source control systems.** Romanov, Yu.I. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1983. (In Russian). NTIS (US Sales Only), PC A19/MF A01. File Number DE85781610. (CONF-8210133—Vol.2).

From 8. All-Union conference on the charged particle accelerators; Protvino, USSR (19 Oct 1982).

Fiber-optical transmission lines (FOTL), used for information transmission between the control systems of accelerator ion sources are described. For multifiber optical cables the high-accuracy electrooptical connectors and optical joints with adjustment are developed. Electrical equipment FOTL receivers and transmitters is performed in the CAMAC standard.

47033 (INIS-SU—302, pp 349-351) **Adaptive system for charged particle beam intensity stabilization.** Kiselev, Yu.V. (AN SSSR, Moscow. Inst. Yadernykh Issledovanij). 1983. (In Russian). NTIS (US Sales Only), PC A19/MF A01. File Number DE85781610. (CONF-8210133—Vol.2).

From 8. All-Union conference on the charged particle accelerators; Protvino, USSR (19 Oct 1982).

Technique of charged particle beam intensity stabilization, which is used in the development of on-tine control system, for the injector of a meson factory linear accelerator has been described. The study of the suggested technique using a bed of the on-line control system has shown the efficiency of its use for the stabilization of charged particle beam intensity under conditions of the injector characteristics drift and in the presence of delay in the control loop.

47034 **(JAERI-M—84-057) Radiation shielding and dose rate distribution for the building of the high dose rate accelerator.** Matsuda, Koji; Takagaki, Torao; Nakase, Yoshiaki; Nakai, Yohta. (Japan Atomic Energy Research Inst., Tokyo). Mar 1984. 76p. (In Japanese). NTIS (US Sales Only), PC A05/MF A01. File Number DE85702158.

A high dose rate electron accelerator was established at Osaka Laboratory for Radiation Chemistry, Takasaki Establishment, JAERI in the fiscal year of 1975. This report shows the fundamental concept for the radiation shielding of the accelerator building and the results of their calculations which were evaluated through the model experiments. After the construction of the building, the leak radiation was measured in order to evaluate the calculating method of radiation shielding. Dose rate distribution of X-rays was also measured in the whole area of the irradiation room as a data base.

47035 (JINR—D-13-84-53, pp 373-375) **Experience development and simulation of computerized system for data acquisition and failure recording of high-current phasotron equipment (F facility).** Denisov, Yu.N.; Anosov, V.N.; Dorukh, Kh.; Krug, Kh.; Leshchenko, G.P.; Onishchenko, L.M.; Potempa, M.; Saenko, V.A.; Shabashov, M.F.; Shishlyannikova, Z.N. 1984. (In Russian). NTIS (US Sales Only), PC A20/MF A01. File Number DE85781324. (CONF-8309239—).

From 11. international symposium on nuclear electronics; Bratislava, Czechoslovakia (13 Sep 1983).

The high-current phasotron computerized control system (CS) is used for data acquisition, processing and visualization as well as for recording energency situations. CS is a multiprocessor hierarchical system at the lower level of which "ELECTRONICA-60" microcomputer processors and at the higher level SM-4 minicomputer processor are used. The CS consists of subsystems controlling separate unit parameters. Each subsystem is divided into two parts: precision measurement system (precision 2 x $10^{-4}$) and fast scanning system (measurement precision 5 x $10^{-3}$ - $10^{-2}$) for recording emergency situations. Electronics is realized in the CAMAC standard.

47036 **(JINR—R-9-84-445) Calculation of channels for forming and transport of medical proton beams at the JINR phasotron.** Kuz'min, E.S.; Mirokhin, I.V.; Molokanov, A.G.; Obukhov, Yu.L.; Savchenko, O.V. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1984. 12p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE85702159.

Results of numerical simulation of shaping and transporting processes of therapeutic proton beams with a modified Bragg curve at the JINR phasotron are presented. The mean energy of proton beams are about 100, 130 and 200 MeV. To provide the flat-topped depth-dose distributions with a steep back slope, the method of shaping with a necessary energy spectrum from a nonmonoenergetic beam is used. It is shown by the calculations that it is possible to choose such modes of the channel operation at which clinical-physical requirements to the parameters of medical proton beams are satisfied. Extensions of flat-tops of dose peaks are 1.3 g/cm$^2$, 1.7 g/cm$^2$ and 3.5 g/cm$^2$ for the 100 MeV, 130 MeV and 200 MeV beam energies, respectively. Dose rate in the peaks of modified distributions are not less than 100 rad per minute.

47037 **(Juel-Spez—300) Study on the modification of the beam transport between the cyclotron and the magnetic spectrograph BIG KARL.** Hinterberger, F. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Kernphysik). Feb 1985. 40p. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number DE85752320.

The planned modification of the beam transport between the Julic Cyclotron and the magnetic spectrograph BIG KARL is discussed in view of the aim of an optimal beam preparation. The report contains a detailed consideration of the ion-optical conditions for dispersion fitting and kinematical fitting. In the framework of the matrix formalism the general form of the fitting conditions is presented.

47038 **(KEK—83-10) Off-line software for large experimental setups.** Bruyant, F. (National Lab. for High Energy Physics, Oho, Ibaraki (Japan)). Jul 1983. 23p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85702160.

The purpose of this report is to emphasize the importance of off-line software for large experimental setups in High Energy Physics. Simple notions of program structuring, data structuring and software organization are discussed in the context of the software developped for the European Hybrid Spectrometer.

47039 **(KIYI—83-21) Test bed for the multicharged ion sources.** Dem'yanov, A.V.; Linev, A.F.; Papash, A.I.; Sakhno, V.I.; Shpachenko, A.I. (AN Ukrainskoj SSR, Kiev. Inst. Yadernykh Issledovanij). 1983. 17p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE85702157.

A stand is described for heavy ion sources characteristic study. Pole diameter scale is 1000 mm. Range of the measured A/Z is from 1 to 25. Magnetic field stability is $10^{-4}$. Arc feed system provides for the obtaining of pulse duration tau=0.2-10 ms, Vg=3000 V, Ig=30 A in pulse. Ion spectra are obtained on stand and work conditions are studied also. Testing was carried out for cathodes made from powder W with Ni impurities by pressing method.

47040 **(LASL—008) Target-blanket design and neutronics.** (Los Alamos Scientific Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 19p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85017448.

The design of a thorium-U233 cycle accelerator breeder target is discussed. (GHT)

47041 **(LBL—18946) New control techniques for extraction of bevalac beams.** Nyman, M.; Chu, W.; Mehlman, B.; Mirer, W.; Oakley, H.; Renner, T.; Stover, G.; Tekawa, M. (Lawrence Berkeley Lab., CA (USA)). May 1985. Contract AC03-76SF00098. 5p. (CONF-850504—274). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85017640.

From Particle accelerator conference; Vancouver, Canada (13 May 1985).

Beams of accelerated heavy ions can now be delivered as one-second-long dc pulses with minimal fluctuations in instantaneous flux. Pulse duration can be held constant to within 1% while keeping a high non-varying extraction efficiency which minimizes pulse-to-pulse position shift in the extracted beam. In addition, differing beam intensities over several orders of magnitude can be delivered. Computer adjustment of all measurement and control devices results in linear operation over three orders of magnitude of beam intensity. Control of beam structure is accomplished by a unique combination of dual slope integrators and phase forward "predictive" circuits in the feedback loop.

47042 **(LBL—18962) Beam profile monitor system for the Bevalac transfer line.** Stover, G. (Lawrence Berkeley Lab., CA (USA)). May 1985. Contract AC03-76SF00098. 6p. (CONF-850504—279). NTIS, PC A02/MF A01; GPO Dep. File Number DE85017669.

From Particle accelerator conference; Vancouver, Canada (13 May 1985).

Incorporated in the current Bevalac transfer line upgrade project is a proposal for a new electronic beam monitoring system. It will be designed to amplify, convert, and transmit the signals of twelve 16 by 16 multi-wire grids to a central computer located in the Bevatron control room. Each station will contain interface amplifiers and a local microprocessor to convert wire grid currents into digitized values which will then be transmitted via a serial data channel to the main computer. The system will have a large dynamic range (1 nano to 1 milli-ampere of beam current), be designed for distributed operation, and will be easily expandable. This paper describes the basic electronic hardware and software components of the proposed system. 10 refs., 3 figs.

47043 (NAC-AR—83-01, pp 216-228) **Research Group.** 1983. NTIS (US Sales Only), PC A12/MF A01. File Number DE85781534.

In Annual report June 1983.

In this part of the report, the following aspects are discussed: the role of nucleon-nucleon interaction in proton-induced reactions on $^{58}$Ni at E(sup p) = 200 MeV; experimental facilities and instrumentation, including a data aquisition room; standards of radioactivity; PIXE analysis for the study of toxic effects of Al in vines and the radiation monitoring system for SPC1.

47044 **(NIIEFA-P-SIU—0626) Experiments on the INUS-3 electron accelerator with inductive energy storage.** Burtsev, V.A.; Gusev, O.A.; Il'in, B.N.; Mellekh, E.M.; Pavlov, E.P.; Pecherskij, O.P.; Polyanskij, M.Yu.; Spitsyn, G.A.; Shchegolikhin, N.P. (Nauchno-Issledovatel'skij Inst. Ehlektrofizicheskoj Apparatury, Leningrad (USSR)). 1983. 16p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE85702161.

The results of experiments on the "INUS-3" high-current pulse electron accelerator with inductive energy storage are pre-

sented. Perspecs of using oxide-nickel cathode in the $10^{-4}$-$10^{-3}$ s range of pulse duration is revealed. The results of experiments on additional acceleration of electron beam when changing its intensity are given. Experiments on using electron beam for quenching spark gap tube applied in the electron supply system as a circuit breaker are described. Peculiarities of quenching circuit which permit to disconnect the "back current" generator from the circuit to the moment of beginning of accelerating voltage pulse shaping are noted. Preliminary data on tests in the accelerator high-voltage supply system of some circuits for high-voltage pulse shaping using inductive energy storage as a sectionary inductor of an artificial shaper are also presented.

47045 **Effect of resonant microwave power on a Penning ionization gauge ion source.** Brown, I.G.; Galvin, J.E.; Gavin, B.F.; MacGill, R.A. (University of California, Lawrence Berkeley Laboratory, Berkeley, California 94720). *Review of Scientific Instruments;* **56**: No. 10, 1894-1896(Oct 1985).

Microwave power resonant to the local electron cyclotron frequency has been coupled into the plasma discharge chamber of a hot-cathode PIG (Philips or Penning Ionization Gauge) ion source. The extracted ion beam was monitored for changes in characteristics of the beam with and without application of the microwave power. No change was seen in the ion charge state distribution. A small but significant reduction in the beam noise level was seen, and this technique may thus find application in situations where beam quiescence is important.

47046 **Inexpensive computer data-acquisition system.** Galvin, J.E.; Brown, I.G. (University of California, Lawrence Berkeley Laboratory, Berkeley, California 94720). *Review of Scientific Instruments;* **56**: No. 10, 1972-1972(Oct 1985). Contract AC03-76SF00098.

A system based on an Apple II+ personal computer is used for on-line monitoring of ion-beam characteristics in accelerator ion source development.

## 4304 Storage Rings

47047 **(CEA-CONF—7587) Observation of the substructure in the electron bunch on the ACO storage ring.** Bergher, M.; Velghe, M.; Mialocq, J.P. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Sep 1984. 13p. (CONF-8409144—7). NTIS (US Sales Only), PC A02/MF A01. File Number DE85752163.

From Free electron laser conference; Castelgandolfo, Italy (3 Sep 1984).

In the future, one interesting point of the SRFEL at Orsay will be the microtemporal analysis of the laser beam correlated with that of the electron bunch. In a first time, we have only analysed the temporal structure of the electron bunch with an Electrophotonic streak camera. The first results seem to indicate that the bunch is not an homogeneous bunch but presents a substructure. We discuss with details this data.

47048 **(CEA-CONF—7590) Diagnostic techniques and VUV induced degradation of the mirrors used in the Orsay storage ring free-electron laser.** Elleaume, P.; Velghe, M.; Billardon, M.; Ortega, J.M. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Sep 1984. 2p. (In French and English). (CONF-8409144—6). NTIS (US Sales Only), PC A02/MF A01. File Number DE85752157.

From Free electron laser conference; Castelgandolfo, Italy (3 Sep 1984).

Published in summary form only.

47049 (GSI—85-10, pp 347-365) **RHIC and quark matter: A proposed heavy ion collider at Brookhaven National Laboratory.** Ludlam, T. Mar 1985. B. File Number DE85752251. (CONF-8410210—).

From 7. high energy heavy ion study conference; Darmstadt, F.R. Germany (8 Oct 1984).

An intensive design effort has been carried out at Brookhaven for a dedicated Relativistic Heavy Ion Collider (RHIC) using the existing site, tunnel, cryogenic refrigerator and experimental areas of the CBA project.

47050 (INIS-SU—302, pp 375-379) **Simulation of ion accumulation in electron beams.** Perel'shtejn, Eh.A.; Shevtsov, V.F.; Shirkov, G.D.; Shchinov, B.G. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1983. (In Russian). NTIS (US Sales Only), PC A19/MF A01. File Number DE85781610. (CONF-8210133—Vol.2).

From 8. All-Union conference on the charged particle accelerators; Protvino, USSR (19 Oct 1982).

Ion distribution functions during consecutive ion charge multiplication in a linear ring electron beam are investigated. Effect of nonlinearity of intrinsic fields of electrons and ions on ion motion and ion distribution function has been considered. The results obtained can be applied to thin electron rings, provided their curvature is neglected. It is shown, that the account of non-equilibrium electron density in the beam profile results in the following: the mean square dimensions of ion components decrease more rapidly (in proportion to $1/\sqrt{i}$, where i - ion charge) with the charge increase, than it has been previously obtained for constant electron density, and efficient phase volumes decrease similar as dimensions. Results of numerical calculations showed that nonlinearity of electron intrinsic fields affects but slightly the ion distribution functions, and during low-charge ion accumulation in the case of insignificant final neutralization factors $f <$ or approximately 0.1-0.2 the distortion of electric potential shape is not considerable. In the process of multicharge ion production the final parameters of ion beams to a considerable extent are determined by the initial stage of multiplication when the decrease of dimensions is the highest.

47051 **(KEK—83-7) Longitudinal coupled bunch oscillation observed in the KEK-PF electron storage ring.** Yamazaki, Yoshishige; Kobayakawa, Hisashi; Kamiya, Yukihide; Kihara, Motohiro. (National Lab. for High Energy Physics, Oho, Ibaraki (Japan)). Jun 1983. 26p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85702163.

A longitudinal coupled bunch oscillation was observed in the KEK Photon Factory electron storage ring. The oscillation was arising from a high shunt impedance of a TM011-like mode in RF accelerating cavities. The oscillation never led to a beam loss. Instead, the amplitude of the oscillation stopped growing at a certain value, where the amplitude modulation was observed. The RF frequency dependence of the threshold of the oscillation was well described in terms of the frequency dependence of the cavity impedance. The absolute value of the threshold of the oscillation is about four times higher than predicted.

47052 **(KEK—83-8) Measurement of damping time and frequency of coherent synchrotron oscillation in PF storage ring.** Kobayakawa, Hisashi; Yamazaki, Yoshishige; Kamiya, Yukihide. (National Lab. for High Energy Physics, Oho, Ibaraki (Japan)). Jun 1983. 12p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85702164.

The damping time and the frequency of the coherent synchrotron oscillation in the PF storage ring were studied. A weak beam phase oscillation was induced by feeding an external perturbation to an acceleration phase control circuit, and the beam oscillation was measured with a signal from a beam position monitor. Observed damping was much stronger than that of the calculated value using the Robinson damping mechanism.

47053 **(KEK—83-9) Tuner control system for the PF cavity.** Kobayakawa, Hisashi; Yamazaki, Yoshishige. (National Lab. for High Energy Physics, Oho, Ibaraki (Japan)). Jun 1983. 14p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85702165.

The tuner control system for the acceleration cavity of the Photon Factory storage ring is described. The tuner control is made by the voltage corresponding to the phase difference between the input signal and the sampled signal of the cavity. In this way the reactive beam loading and also effect due to the temperature change are automatically compensated. Performance of the system and operational experiences particularly at the beam injection are presented.

47054 **(KEK—83-17) Partially filled multi-bunch mode operation of the photon factory electron storage ring and cure of the vertical instability.** Yamazaki, Yoshishige; Kihara, Motohiro; Kobayakawa, Hisashi. (National Lab. for High Energy Physics, Oho, Ibaraki (Japan)). Oct 1983. 30p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85702162.

Accelerator studies were made in the Photon Factory storage ring by filling the bunches partially and uniformly. The vertical instability probably arising from the ion accumulation inside the electron beam in the uniformly filled mode operation could be eliminated by populating the bunches partially, but a presumably different vertical instability appeared. Machine parameters that stop the vertical instabilities were found. Variations of the betatron tunes, tune spreads and vertical beam size with the stored beam current could be eliminated by the partial filling.

47055 **(UCID—20498) SLAC divertor channel entrance thermal stress analysis.** Johnson, G.L.; Stein, W.; Lu, S.C.; Riddle, R.A. (Lawrence Livermore National Lab., CA (USA)). 10 Jul 1985. Contract W-7405-ENG-48. 69p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85017877.

X-ray beams emerging from the new SLAC electron-positron storage ring (PEP) impinge on the entrance to tangential divertor channels causing highly localized heating in the channel structure. Analyses were completed to determine the temperatures and thermally-induced stresses due to this heating. These parts are cooled with water flowing axially over them at 30°C. The current design and operating conditions should result in the entrance to the new divertor channel operating at a peak temperature of 123°C with a peak thermal stress at 91% of yield. Any micro-cracks that form due to thermally-induced stresses should not propagate to the coolant wall nor form a path for the coolant to leak into the storage ring vacuum. 34 figs., 4 tabs.

# 44 INSTRUMENTATION

## 4401 Radiation Instrumentation

*REFER ALSO TO CITATION(S) 46225, 46227, 46228, 46231, 46532, 46718, 47166, 47476, 47560, 47560, 47865*

47056 **(AD-A—155069/8/XAB) Paired ion-chamber constants for fission gamma-neutron fields. Technical report.** Ferlic, K.P. (Armed Forces Radiobiology Research Inst., Bethesda, MD (USA)). Dec 1984. 34p. NTIS, PC A03/MF A01.

Paired ionization chamber constants are calculated for the 50-cm$^3$ spherical ionization chambers used in dosimetry of the AFRRI TRIGA reactor. The calculations include the most recently available information on energy spectra for neutron and gamma radiation present in AFRRI reactor exposure rooms, as well as for kerma factors and W-values of neutrons. The constant kT, which expresses neutron sensitivity of the 50-cm$^3$ tissue equivalent (TE) ion chamber filled with TE gas, ranged from 0.92 to 0.96 among the 18 different neutron spectra for which calculations were done. The constant kU, which expresses neutron sensitivity of the 50-cm$^3$ graphite ion chamber filled with $CO_2$, ranged from 0.07 to 0.11 among the same spectra. The constant hT, which expresses gamma sensitivity of the TE/TE ion chamber, was taken to be unity for all spectra. The constant hU, which expresses gamma sensitivity of the C/CO2 ion chamber, was 0.99 + or - 0.01(range) for all spectra. These calculations will serve as the basis for future dosimetry with the 50-cm$^3$ ion chambers at the AFRRI TRIGA reactor.

47057 **(BNL—36780) Experiments in the fragmentation regions.** Faessler, M.A.; Bond, P.D.; Remsberg, L. (Brookhaven National Lab., Upton, NY (USA); European Organization for Nuclear Research, Geneva (Switzerland)). 1985. Contract AC02-76CH00016. 15p. (CONF-8504152—6). NTIS, PC A02/MF A01; GPO Dep. File Number DE85016063.

From Workshop on experiments for RHIC; Upton, NY, USA (15 Apr 1985).

The fragmentation region is generally defined as the rapidity range where most of the valence partons of the incoming hadrons (or nuclei) are found after normal inelastic interactions. The disadvantages of the existing intersection region for fragmentation region studies are discussed and a slightly modified design is proposed which allows study of the fragmentation region. The considerations which led to the design of a spectrometer magnet are then outlined and some approaches to specific experiments are detailed. 4 refs., 6 figs., 2 tabs. (LEW)

47058 **(CERN-EP—84-98) Use of Cherenkov techniques for total absorption measurements.** Heusch, C.A. (European Organization for Nuclear Research, Geneva (Switzerland)). 8 Aug 1984. 56p. (CONF-8407116—2). NTIS (US Sales Only), PC A04/MF A01. File Number DE85902033.

From Seminar on Cerenkov detectors and their applications in science and technology; Moscow, USSR (1 Jul 1984).

Electromagnetic and hadronic cascade features are reviewed as they pertain to Cherenkov detection. By a sample of devices, the design and performance of detectors that make use of these features in various ways, through a large range of applications to various physical phenomena, and of total energies measured, are highlighted. Examples include lead-glass systems, lead-lucite sandwiches, and water Cherenkov counters. 27 refs., 37 figs. (LEW)

47059 **(CERN-EP—85-54) Calorimetry in high-energy physics.** Fabjan, C.W. (European Organization for Nuclear Research, Geneva (Switzerland)). 19 Apr 1985. 58p. (CONF-8408160—1). NTIS (US Sales Only), PC A04/MF A01. File Number DE85901950.

From NATO advanced study institute on techniques and concepts of high energy physics; St. Croix, VI, USA (2 Aug 1984).

The principal features of detectors designed to measure the energy of photons and electrons, the "electromagnetic shower detectors" (ESD), are briefly reviewed. The physics of the "hadronic calorimeters" is reviewed. By selected examples, the technical issues of information processing from calorimeters are discussed. 170 refs., 25 figs. (LEW)

47060 (CONF-791122—Absts., pp 27) **Estimation of exposure rate due to gamma-rays from standard sources used for calibration of a doserate-meter.** Urabe, I.; Yoshimoto, T.; Tsujimoto, T.; Katsurayama, K. (Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst.). 1979. NTIS (US Sales Only), PC A04/MF A01. File Number DE82904129. (INIS-mf—9485).

From 2. Asian regional congress on radiation protection; Manila, Philippines (5 Nov 1979).

Published in abstract form only.

47061 (CONF-791122—Absts., pp 39) **High sensitive freon-filled ionization chamber for monitoring environmental radiation dose.** Yamasaki, K.; Okamoto, K.; Tsujimoto, T.; Katsurayama, K. (Kyoto Univ., Kumatori, Osaka (Japan). Research Reactor Inst.). 1979. NTIS (US Sales Only), PC A04/MF A01. File Number DE82904129. (INIS-mf—9485).

From 2. Asian regional congress on radiation protection; Manila, Philippines (5 Nov 1979).

Published in abstract form only.

47062 **(DESY—85-038) Influence of the transverse beam sizes on the epsilonrho -> epsilonrho$\gamma$ cross section at HERA.** Kotkin, G.L.; Polityko, S.I.; Serbo, V.G. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Feb 1985. 11p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85752323.

Luminosity measurement on the HERA accelerator is planned to be carried out by means of the epsilonrho -> epsilonrho$\gamma$ process. We note that in this process impact parameters occur which are larger than the transverse beam sizes. This leads to a decrease in the number of the observed photons as compared with standard calculations. Our calculations show that the difference is greater than 10% at the photon energy Esub($\gamma$) < 0.04 Esub(e).

47063 (DOE/ER/10713—6B) **Studies of $e^+e^-$ interactions. Progress report, August 1, 1984-July 31, 1985.** Abashian, A. (Virginia Polytechnic Inst. and State Univ., Blacksburg (USA)). Aug 1985. Contract AS05-80ER10713. 17p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85017190.

Progress is reported in the development of the AMY electromagnetic shower counter. The design of the detector has been finalized. Fabrication of components was begun. Techniques have been developed to construct the detector with precision and reliability. Activities have been conducted to assess the expected performance of the completed detector. Appended are notes on the adhesive strength of epoxy for tensile stress and on the effects of distance between cathodes and plastic tubes on cathode signals. (LEW)

47064 (DOE/EV/04957—5) **In vivo detection, localization and measurement of radionuclides in man: a detection system for the localization and measurement of small amounts of photon emitters. Final report.** Laurer, G.R. (New York Univ., NY (USA). Inst. of Environmental Medicine). 1 Aug 1985. Contract AC02-78EV04957. 41p. (COO—4957-5). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85017601.

A new detector has been devised which, by providing a significant increase in geometric counting efficiency, allows a concurrent reduction in the amount of radioactivity needed to produce an image of the deposition site(s) of radionuclides in humans and/or experimental animals. Consisting of four wedgeshaped NaI(Tl) crystals in a unique geometrical arrangement, the crystals themselves function as the collimator generally employed in radionuclide imaging applications. The four crystals, when coupled, become a 4-crystal unit detector; joined so their active faces form the silhouette of a pyramid. The outside, vertically oriented, rectangular faces of each crystal are placed back-to-back with those of adjoining detectors. Thus, small or large arrays of the 4-crystal unit detectors may be assembled. In practice, the array of detectors will be moved in fixed, discrete steps over the source of radiation to be imaged. As a result of its shape, each count obtained from each crystal at each counting position is different, relative to its position above the source. The array of counts obtained in this manner is the raw spatial information. They are used in a system of linear, simultaneous equations which relate the position of the detectors to the counts obtained at each position. The solution of these equations - utilizing the predetermined point-source-response (PSR) function of the crystals - yields a two-dimensional image of the deposition site of the radioactivity. 18 figs.

47065 (EGG/10282—1057, pp 2.1-2.28) **Radiation and environmental data analysis computer (REDAC) hardware, software band analysis procedures.** Hendricks, T.J. (EG and G Energy Measurements Inc., Las Vegas, NV). Jan 1985. NTIS, PC A19/MF A01. File Number DE85010212. (CONF-830286—).

From Symposium on remote sensing technology; Las Vegas, NV, USA (23 Feb 1983).

The REDAC was conceived originally as a tape verifier for the Radiation and Environmental Data Acquisition Recorder (REDAR). From that simple beginning in 1971, the REDAC has evolved into a family of systems used for complete analysis of data obtained by the REDAR and other acquisition systems. Portable or mobile REDACs are deployed to support checkout and analysis tasks in the field. Laboratory systems are additionally used for software development, physics investigations, data base management and graphics. System configurations range from man-portable systems to a large laboratory-based system which supports time-shared analysis and development tasks. Custom operating software allows the analyst to process data either interactively or by batch procedures. Analysis packages are provided for numerous necessary functions. All these analysis procedures can be performed even on the smallest man-portable REDAC. Examples of the multi-isotope stripping and radiation isopleth mapping are presented. Techniques utilized for these operations are also presented.

47066 (EGG/10282—1057, pp 4.1-4.9) **Derivation of pulse height to exposure rate conversion functions for aerial radiological surveys.** Artuso, J.F. (EG and G Energy Measurements Inc., Santa Barbara, CA). Jan 1985. NTIS, PC A19/MF A01. File Number DE85010212. (CONF-830286—).

From Symposium on remote sensing technology; Las Vegas, NV, USA (23 Feb 1983).

A method is described for deriving conversion functions that can be used to convert pulse height spectra taken at altitude to the exposure rate at the 1-m level. An integral equation is set up which involves the integration of a calculated pulse height spectrum multiplied by an unknown conversion function and then set equal to the exposure rate at ground level. This equation is then solved for the conversion function by assuming as a solution a three-term polynomial. Conversion functions have been derived for various source distributions, including surface, uniform, and exponentially distributed sources. These conversion functions are independent of source energy, which means that a conversion can be made without any knowledge of the isotopic content of the source. In the case of a uniform distribution, these conversion functions provide conversions that agree to within 10% with ground truth measurements.

47067 (EGG/10282—1057, pp 5.1-5.20) **Procedure for the collection of ancillary data for aerial radiological surveys.** DeVore, T.; Mohr, R.; Quam, W. (EG and G Energy Measurements Inc., Santa Barbra, CA). Jan 1985. NTIS, PC A19/MF A01. File Number DE85010212. (CONF-830286—).

From Symposium on remote sensing technology; Las Vegas, NV, USA (23 Feb 1983).

One means of increasing confidence in airborne gamma-ray measurements of the terrestrial radiological environment is through analysis of ground-based data. This section describes a scheme and the equipment used in the field to measure the 1-m gamma exposure rate and the laboratory program wherein quantitative radioisotopic measurements are made on soil samples collected in the field and are converted to exposure rates. It also presents some typical ground-based data together with aerial results to illustrate its use.

47068 (EGG/10282—1057, pp 22.1-22.15) **Multiple application computer system (MACS).** Cleland, J.R.; Rehm, L.R. (EG and G Energy Measurements Inc., Las Vegas, NV). Jan 1985. NTIS, PC A19/MF A01. File Number DE85010212. (CONF-830286—).

From Symposium on remote sensing technology; Las Vegas, NV, USA (23 Feb 1983).

This section describes a low power microcomputer based system which performs all of the AMO search gear functions with a single set of hardware. The systems are connected through a serial data link to a host computer for automated control and checkout. The software is a multi-tasking system with executives, schedules, math libraries, etc., and will allow up to 32 programs to run concurrently.

47069 (EGG/10282—1057, pp 1.1-1.18) **Recent advances in airborne radiometric technology.** Jobst, J.E. (EG and G Energy Measurements Inc., Las Vegas, NV). Jan 1985. NTIS, PC A19/MF A01. File Number DE85010212. (CONF-830286—).

From Symposium on remote sensing technology; Las Vegas, NV, USA (23 Feb 1983).

Since its inception, the DOE Remote Sensing Laboratory has made dramatic innovations in airborne radiometric technology. In the past few years there have been at least four major changes in operational philosophy. (1) The helicopter is now the prime radiation survey vehicle. Surveys are conducted at low speed and low altitude, with lines spaced only a few hundred feet apart. Radiation anomalies and subtle changes in background can be readily identified. (2) Much greater emphasis is now placed on accurate, detailed analysis and interpretation of radiation data. Dramatic improvements in survey hardware and software provide much more data of considerably better quality. (3) Recent Laboratory research has been concentrated on error-free, positive identification of point radiation sources. In the past, the extent and magnitude of dispersed sources were the major concerns. (4) Integrated remote sensing has

been strongly emphasized at the Laboratory in recent years. This involves the simultaneous use of radiation detectors, aerial cameras, and the multispectral scanner imagery. The synergistic effects of such data correlation are of significantly greater value in analyzing the terrestrial environment. Many of the changes in operational philosophy are directly traceable to new or dramatically improved hardware and software employed at the Laboratory. Six items have been instrumental in the above technological advances: (1) the UHF Transponder System and its predecessor, the Microwave Ranging System; (2) Model IC of the REDAR data acquisition system; (3) the development of the search algorithm; (4) continued improvements in the REDACA data analysis system; (5) deployment of polyscin sodium iodide radiation detectors; and (6) development of the Graphic Overview System.

47070 (EGG/10282—1057, pp 3.1-3.16) **Airborne atmospheric monitoring system proposed configuration and capability.** Borella, H.M.; Clark, H.W.; Franks, L.A.; Jobst, J.E. (EG and G Energy Measurements Inc., Las Vegas, NV). Jan 1985. NTIS, PC A19/MF A01. File Number DE85010212. (CONF-830286—).

From Symposium on remote sensing technology; Las Vegas, NV, USA (23 Feb 1983).

EG and G/EM has been tasked to develop an aerial measuring system for monitoring airborne radiation material. The Airborne Atmospheric Monitoring Systems (AAMS) will provide the DOE with a credible emergency response to situations such as Three Mile Island or the Baneberry venting. A study to establish measurement requirements and to review current technology has been completed. Present work focuses on design details of the AAMS. This section reviews the capabilities, configuration, and instrumentation of the system. The concept being developed provides the following capabilities: (1) identification of gamma and alpha emitting radionuclides; (2) particulate sampling; (3) measurement of alpha, beta, and gamma emitter concentrations (including iodine); (4) measurement of gamma exposure rate; (5) estimates of alpha and beta exposure rates; (6) whole gas sampling; and (7) mapping and tracking of radioactive clouds or plumes. A Convair 580 will be used as an aerial platform. A subset of these capabilities and the required instrumentation can be provided for use on any helicopter or aircraft.

47071 (EGG/10282—1057, pp 28.1-28.24) **In situ gamma analysis system.** Reiman, R.T. (EG and G Energy Measurements Inc., Las Vegas, NV). Jan 1985. NTIS, PC A19/MF A01. File Number DE85010212. (CONF-830286—).

From Symposium on remote sensing technology; Las Vegas, NV, USA (23 Feb 1983).

EG and G/EM has successfully fielded an in situ gamma analysis system employing high purity germanium gamma detectors. The system has proven useful in radiological assessment and cleanup operations. The system, its calibration, operation, and past applications are discussed.

47072 (EGG/10282—1057, pp 30.1-30.5) **Fast neutron imaging detector.** Bhattacharjie, A.; Profio, A.E.; Sarnaik, J. (EG and G Energy Measurements Inc., Santa Barbara, CA). Jan 1985. NTIS, PC A19/MF A01. File Number DE85010212. (CONF-830286—).

From Symposium on remote sensing technology; Las Vegas, NV, USA (23 Feb 1983).

An imaging fast neutron detector is being developed for localization of distant sources, and for fast neutron radiography. Design objectives include high detection efficiency for neutrons above 1 MeV, good spatial resolution, and low sensitivity to gamma rays. High neutron detection efficiency is combined with good spatial resolution (~1 mm) in an NE213 organic scintillator made like an imaging fiberoptic cable, with the fibers aligned along the collimated neutron beam. One end of the fiber matrix is optically coupled to a very high gain image intensifier, such that individual neutrons are detected. The other end of the matrix is coupled to a photomultiplier tube for pulse shape discrimination against gamma rays. In order to apply pulse shape discrimination it is necessary to register simultaneously the X and Y coordinates, and the risetime of the scintillation pulse. The best method of accomplishing this is being investigated.

47073 (EGG/10282—1057, pp 32.1-32.18) **Developments in thicker mercuric iodide detectors.** Beyerle, A.; Hull, K.; Markakis, J. (EG and G Energy Measurements Inc., Santa Barbara, CA). Jan 1985. NTIS, PC A19/MF A01. File Number DE85010212. (CONF-830286—).

From Symposium on remote sensing technology; Las Vegas, NV, USA (23 Feb 1983).

Mercuric iodide ($HgI_2$) has been used for radiation detectors for several years. A summary of recent work studying the properties of thicker sections (~1 cm) of mercuric iodide is presented. This work has yielded improvements in spectroscopic performance of detectors thick enough to have reasonable (>30%) efficiencies for gamma-rays (660 keV). Best results have been obtained using a novel short charge collection technique. Spectra for both short and the traditional charge collection shaping times are presented for gamma-ray energies up to 1.33 MeV ($^{60}Co$). Certain detector conditioning effects which enhance spectral performance are discussed. Charge carrier property experiments are discussed in the context of improved results.

47074 (EGG/10282—1057, pp 23.1-23.22) **Low background Ge(Li) detector gamma-ray spectroscopy system with sample changer.** Mohr, R.A.; Quam, W.M. (EG and G Energy Measurements Inc., Santa Barbara, CA). Jan 1985. NTIS, PC A19/MF A01. File Number DE85010212. (CONF-830286—).

From Symposium on remote sensing technology; Las Vegas, NV, USA (23 Feb 1983).

A gamma-ray spectroscopy system used for analysis of volume soil and vegetation samples is described. It can accept samples of up to 2 kg weight and a 970 $cm^3$ volume. Its primary use is in the determination of U, Th, $^{137}Cs$, $^{40}K$, and $^{60}Co$ in samples obtained during ground truth AMS surveys throughout the country. The system was calibrated using standards from the DOE New Brunswick Laboratory and from the National Bureau of Standards. Detectabilities (at $3\sigma$) in a 1500-g sample are: 0.28 ppm Th, 0.10 ppm U, 10 pCi $^{40}K$, 1.0 pCi $^{137}Cs$, and 1.0 pCi $^{60}Co$.

47075 (EGG/10282—1057, pp 27.1-27.11) **Gamma search algorithm using shape matching of integral spectra.** Bhattacharjie, A. (EG and G Energy Measurements Inc., Santa Barbara, CA). Jan 1985. NTIS, PC A19/MF A01. File Number DE85010212. (CONF-830286—).

From Symposium on remote sensing technology; Las Vegas, NV, USA (23 Feb 1983).

A new gamma background stripping method has been developed for real-time search of localized sources of radiation. The method uses a stored reference shape of background integral spectra, constructed in the field and updated at regular intervals, and compares it statistically with newly acquired shapes to determine the presence of any local anomalies. The methodology is discussed along with preliminary results using background spectra in the Las Vegas area and a helicopter-based gamma detection system.

47076 (EGG/10282—1057, pp 10.1-10.9) **Development of the multispectral remote sensing department acquisition capabilities in the aerial measurements operations of EG and G/EM.** Hawley, D.L. (EG and G Energy Measurements Inc., Las Vegas, NV). Jan 1985. NTIS, PC A19/MF A01. File Number DE85010212. (CONF-830286—).

From Symposium on remote sensing technology; Las Vegas, NV, USA (23 Feb 1983).

The electro-optical data acquisition capabilities within the Aerial Measurements Operations (AMO) are in the Multispectral Remote Sensing Department. This was begun in 1977 with the acquisition of a Daedalus multispectral scanner (MSS) as the principal data collection instrument. More recently a thermal infrared imager and a pyroelectric vidicom have been acquired. In addition to the data acquisition instruments, considerable ground truth equipment has been obtained. Progress has also been made in the number and variety of aircraft in which the principal data acquisition instruments can be flown. This involves not only fixed-wing, but also helicopters. Reliable navigation has also progressed in the past years, primarily with the help of other departments in AMO sharing their experience. Upgrades to the acquisition instrumentation focuses on the technological advances in multispectral scanners

which will allow better spatial, radiometric, and overall system responses to be improved. Two upgrades are discussed.

47077 **(EUR—8932) Environmental monitoring. European interlaboratory test programme for integrating dosemeter systems.** Piesch, E.; Burgkhardt, B. (Commission of the European Communities, Luxembourg). 1984. 132p. Commission of the European Communities, Luxembourg.

The aim of the interlaboratory test was primarily to offer an improved standardized calibration technique to the laboratories engaged in environmental monitoring. On the basis of the results each laboratory was able to check the properties of its own dosemeter system and to compare its results with those of other laboratories. The tests in detail provided a better understanding of the read-out technique and suggested ways of improving the properties of the dosemeter system used. After evaluation the results of the test programme were discussed. (The main subjects of the discussion are summarized). In contrast to personal dosimetry, the demands placed on the application of TLD systems in environmental monitoring include long-term exposure in the environment, high accuracy of dose measurements in the low-dose range, low fading and long-term reproducibility of the dosemeter system. The commercially available dosemeter systems attain the objective only to a limited extent and require additional calibration in the low-dose range. In addition, published data on the dosimetric properties of a particular reader type or dosemeter system can by no means be transferred to each individual instrument of the same reader type.

47078 **(FEI—1405) Metrological characteristics of surface activation method.** Leonov, A.I.; Konstantinov, I.O.; Tarasko, M.Z. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.). 1983. 13p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE85702153.

Metrological characteristics of surface activation method by accelerated charged particles used for investigation and testing of processes of surface destruction in products (wear, corrosion, etc.) are considered. The relation between mean square deviation, sensitivity, detection limit, resolution abitity and conditions of activation, radiometry and catibration. The potentialities of the method for remote determination of the value of the layer removed are shown using the case of structural steel activation ($Fe+p \rightarrow {}^{56}Co$, Esub(p)=11.0 MeV). Caiibration curves are presented.

47079 **(FRNC-TH—1629) Numerical simulations for the study of a cosmic γ-ray imagery experiment.** Monnier, C. (Toulouse-3 Univ., 31 (France)). Jul 1982. 129p. (In French). NTIS (US Sales Only), PC A07/MF A01. File Number DE85752175.

Basic principles of imagery are reviewed and their applications to a γ-ray imagery device are explained. This device is based on a coded mask associated with a detector which is sensitive to the position of interaction of the γ-ray photons. A group of simulation programs is described. These programs are for use in evaluating the performance of such an experiment the sensitivity, the angular resolution, and that for different configurations. The influence of an inhomogeneous background noise on the detector has also been studied.

47080 **(IFVE-OEF—84-108) Cherenkov radiation detection by the wire chamber operating in self-quenching streamer mode.** Buzulutskov, A.F.; Vasil'chenko, V.G.; Vashchenko, V.Yu.; Myalitsin, V.K.; Ronzhin, A.I.; Turchanovich, L.K. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1984. 16p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE85702215.

Submitted to the journals Instrum. Exp. Tech. and Nucl. Instr. Meth. .

A self-quenching streamer (SQS) mode has been obtained in a wire chamber filled with $CH_4$+triethylamine mixture. Individual Cherenkov radiation photons originating from β-electron motion in the LiF crystal have been efficiently detected for the first time in the SQS mode. Photodetectors based on a multistep proportional chamber and photomultiplier with a tellurium-cesium photocathode have been manufactured to measure the SQS chamber efficiency in the vacuum ultraviolet radiation range.

47081 **(IFVE-ONF—84-51) MARS-2: liquid argon calorimeter with a wide gap electrode system.** Denisov, S.P.; Krasnokutskij, R.N.; Dzhennaro, D. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1984. 19p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE85702216.

Submitted to the journal Nucl. Instr. Meth. .

The performances of a liquid argon calorimeter with large gaps (2.8 cm) between electrodes wepe studied in 6.6-36 GeV electron beam and 40 GeV hadron beam at the IHEP accelerator. The calorimeter operational mode provided a signal independent of the charge generation point in the gaps between electrodes thus, the sampling fluctuations were reduced. The value measured for the sampling fluctuations turned out to be eqUal to $\sigma/E=0.04$ x Esup(-1/2)% (E in GeV). The calorimeter space and angular resolution has been determined. The RMS level of the noise signals is 82 MeV for the whole detector.

47082 **(IFVE-ONF—84-80) SKAT bubble chamber film processing.** Baranov, D.S.; Zakamskij, L.L.; Ivanilov, A.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1984. 12p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE85702217.

The technique of SKAT bubble chamber photographic image processing is briefly described. On the base of the technique 125000 images were processed in neutrino-seances and 182000 images in antineutrino seances. The analysis of geometric reconstruction of the events has shown that: the geometric program restores the spatial point coordinates non shifted relative to each other; spatial coordinate errors are estimated correctly; charged particle pulses are restored correctly both in a low-pulse and high-pulse part of hadrons; charged particle pulse errors are estimated correctly. The average relative error in visible energy of neutrino reactions equals approximately 10%.

47083 (INIS-mf—9351, pp 155-161) **Some critical remarks on the determination of masses from beta endpoint measurements.** Muennich, F.; Keyser, U.; Pahlmann, B. (Technische Univ. Braunschweig (Germany, F.R.). Inst. fuer Metallphysik und Nukleare Festkoerperphysik). 1984. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781594. (CONF-8409143—).

From 7. international conference on atomic masses and fundamental constants (AMCO-7); Darmstadt-Seeheim, F.R. Germany (3 Sep 1984).

The main properties of the β-detectors used in the Qsub(β)-measurements are summarized. The problems in the determination of the endpoints of β-singles and βγ-coincidence spectra measured with these detectors are discussed. (orig.).

47084 (INIS-mf—9652, pp 58) **Precision lambdameter with a magnetically suspended measuring carriage.** Musso, M.; Neureiter, C.; Windholz, L.; Jaeger, H. (Technische Univ., Graz (Austria)). 1984. (In German). NTIS (US Sales Only), PC A07/MF A01. File Number DE85781476. (CONF-8409235—Summ.).

From Annual meeting of the Austrian Physical Society; Leoben, Austria (24 Sep 1984).

Published in summary form only.

47085 (INIS-mf—9652, pp 111) **Photodetectors for picosecond spectroscopy.** Perger, A.; Tichawa, N. (Technische Univ., Vienna (Austria)). 1984. (In German). NTIS (US Sales Only), PC A07/MF A01. File Number DE85781476. (CONF-8409235—Summ.).

From Annual meeting of the Austrian Physical Society; Leoben, Austria (24 Sep 1984).

Published in summary form only.

47086 (INIS-mf—9652, pp 43) **Application of silicon single crystals in neutron optics.** Rauch, H.; Seidl, E. (Atominstitut der Oesterreichischen Universitaeten, Vienna). 1984. (In German). NTIS (US Sales Only), PC A07/MF A01. File Number DE85781476. (CONF-8409235—Summ.).

From Annual meeting of the Austrian Physical Society; Leoben, Austria (24 Sep 1984).

Published in summary form only.

47087 (INIS-mf—9652, pp 124) **Semiconductor detectors in high energy physics.** Regler, M. (Oesterreichische Akademie der Wissenschaften, Vienna. Inst. fuer Hochenergiephysik). 1984. (In German). NTIS (US Sales Only), PC A07/MF A01. File Number DE85781476. (CONF-8409235—Summ.).

From Annual meeting of the Austrian Physical Society; Leoben, Austria (24 Sep 1984).

Published in summary form only.

47088 (INIS-mf—9676) **Study of a plastic detector as a neutron dosimeter.** Cuauhtecatl Hernandes, V. (Instituto Politecnico Nacional, Mexico City. Escuela Superior de Fisica y Matematicas). 1982. 85p. (In Spanish). NTIS (US Sales Only), PC A05/MF A01. File Number DE85781613.

Studies were carried out through nuclear reactions (n, p); (n, heavy ion), and (n,α) of the dosimetric properties of CR 39 commercial brand polymers. A system was devised for calculating the number of neutron induced nuclear reactions and geometric absolute efficiency factors. Feasibility of the utilization of CR 39 in monitoring and in personnel dosimeters is also discussed. (author).

47089 (INIS-mf—9742, pp 70-76) **Contrast enhancement of autoradiogram half-tone image.** Yampol'skij, V.V.; Majorov, A.N.; Nosukhin, L.S.; Tsobenko, V.V. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow). 1983. (In Russian). NTIS (US Sales Only), PC A12/MF A01. File Number DE85781598. (CONF-8305206—).

From 13. international symposium on autoradiography; Tabor, Czechoslovakia (2 May 1983).

The cellulose nitrate track detector was irradiated with alpha particles. In order to enhance the track contrast the method was studied of dyeing the detector surface with rhodamine G. The dependence is shown of optical density on the irradiation time of the detector with alpha particles of an energy of 4.2 MeV for a dyed and non-dyed detector. Optimized conditions are discussed for detector dyeing. The best results are obtained using the saturated solution of rhodamine in 80% ethanol. (E.S.).

47090 (INIS-mf—9742, pp 211-214) **Application of autoradiography in finger print analysis.** Stverak, B.; Kopejtko, J.; Simek, J. (Ustav pro Vyzkum, Vyrobu a Vyuziti Radioisotopu, Prague (Czechoslovakia)). 1983. (In German). NTIS (US Sales Only), PC A12/MF A01. File Number DE85781598. (CONF-8305206—).

From 13. international symposium on autoradiography; Tabor, Czechoslovakia (2 May 1983).

In order to broaden the possibilities of developing latent finger prints a tracer technique has been developed using sup(110m)Ag and autoradiographic imaging. This method has been tested on glass, paper and certain plastics. On paper it is possible to visualize finger prints even after previous development using Ninhydrin. It is shown that usable finger prints may be obtained also from materials from which they cannot be obtained using classical methods, e.g., polyethylene and simulated leather. (author).

47091 (INIS-mf—9742, pp 40) **Development of high-sensitivity CR-39 track detectors for charged-particle radiography.** Somogyi, G.; Szilagyi, S.; Hunyadi, I.; Hafez, A.F. (Magyar Tudomanyos Akademia, Debrecen. Atommag Kutato Intezete). 1983. NTIS (US Sales Only), PC A12/MF A01. File Number DE85781598. (CONF-8305206—).

From 13. international symposium on autoradiography; Tabor, Czechoslovakia (2 May 1983).

Published in summary form only.

47092 (INIS-mf—9742, pp 41) **Effects of the degree of substitution on the properties of the CN-track detector.** Lueck, H.B. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)). 1983. NTIS (US Sales Only), PC A12/MF A01. File Number DE85781598. (CONF-8305206—).

From 13. international symposium on autoradiography; Tabor, Czechoslovakia (2 May 1983).

Solid state nuclear track detectors (SSNTD) were prepared from cellulose nitrate of different degrees of substitution (DS). Two different ways of nitration were used to obtain cellulose nitrate with a DS from 2.63 to 2.97. It was found that the DS has a strong effect on the surface etch rate and the response function of the SSNTD. The study reveals that the registration sensitivity of a CN track detector with an optimum DS exceeds the sensitivity of the CR-39 detector in a broad energy range for protons and alpha particles. (author).

47093 (INIS-mf—9742, pp 90-98) **New automatic track counting and analysing system: the Digitrack.** Molnar, J.; Somogyi, G.; Szilagyi, S.; Sepsy, K. (Magyar Tudomanyos Akademia, Debrecen. Atommag Kutato Intezete). 1983. NTIS (US Sales Only), PC A12/MF A01. File Number DE85781598. (CONF-8305206—).

From 13. international symposium on autoradiography; Tabor, Czechoslovakia (2 May 1983).

A microprocessor supported instrument called DIGITRACK has been developed for the evaluation of etch-track parameters in solid state nuclear track detectors. The picture analysis is performed with a photosensitive semiconductor device of the type Fairchild CCD 121HC mounted on a Leitz Ortholux microscope. One row of the picture is converted into 1728 binary signals by thresholding logic. The picture elements are analysed by a microcomputer equipped with INTEL 8080 microprocessors. The pattern recognition software procedure separates the overlapping tracks and determines the number, surface area and x-y coordinate of the tracks in a given detector area. The distribution of track sizes and spatial track densities in a radiogram can be visualized on a graphic display. The DIGITRACK system works at low microscopic magnification (2 to 10 x) and thus the automatic track evaluation can be performed at high speed. (author).

47094 (INIS-mf—9758, pp vp) **Nordic film dosimetry comparison 1984.** Ennow, K. (Statens Inst. for Straalehygiejne, Copenhagen (Denmark)); Kiibus, A. (Statens Straalskyddsinstitut, Stockholm (Sweden)); Tanninen, A. (STUK, Helsinki, Finland); Woehni, T. (Statens Inst. for Straalehygiene, Oslo (Norway)). 1984. (In Danish). NTIS (US Sales Only), PC A08/MF A01. File Number DE85781601. (CONF-8410282—Absts.).

From 7. Nordic Society for Radiation Protection ordinary meeting; Copenhagen, Denmark (10 Oct 1984).

Published in summary form only.

47095 (ITEF—53(1984)) **Calibration of a calorimeter with a fine structure in hadron and electron beams in the momentum range of 0.5 - 6 GeV/c. Results of calibration measurements.** Gorbunov, P.A.; Grigor'ev, E.A.; Zhemanov, V.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1984. 43p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. File Number DE85702218.

To carry out energy calibration of the CHARM target-calorimeter neutrino detector, a calorimeter has been made that has the same structure as the CHARM one but with the smaller lateral and longitudinal dimensions. The results of energy calibration of the scintillation calorimeter with marble absorbers in the $e^{+-}$, $\pi^{+-}$ - and p-beams with pulses from 0.5 to 6 GeV/c are presented. The hodoscope type calorimeter consists of 19 modules. One module comprised an absorber (22 g/cm² of marble and 1.5 g/cm² of aluminium) and a layer of 7 scintillation counters (3 g/cm²). The dependence of visible energy release and energy resolution of the calorimeter on the energy of primary particles and calorimeter structure has been studied. The visible energy release in the calorimeter for electrons linearly depends on the energy and equals approximately

21 equivalent particle per GeV. The energy resolution is found to be 17%/√ E(GeV). For hadrons ($\pi^{+-}$, p) the linear dependence is observed at the energy >2 GeV and the energy release is less by approximately 25% than for electrons, the resolution depends on the energy as 53%/√ E(GeV). A method is suggested to account for the energy leakage for the hadron calorimeter of the finite dimensions. The characteristics of electromagnetic and hadronic showers in the calorimeter substance are studied.

47096 **(JINR—9-84-432) Results of measuring characteristics of cryogenic thermometers-dosimeters on a synchrophasotron beam.** Datskov, V.I.; Zajtsev, L.N.; Muntyan, S.V. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1984. 6p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE85702209.

Cryogenic thermometers-dosimeters and measurement methods based on radiation heating of thermometers were developed. The experimental installation and construction of detectors cooled in liquid helium is described. The experiment was performed on 2.55 GeV proton and 7.31 GeV deuteron beams at 6 ms and 350 ms pulse duration. The dependences of maximum over heating (up to 7 K) of thermometers from particle fluence are obtained. Coefficients of transition from particle fluence to radiation heating for each thermometers are determined. For 7.31 GeV deuteron beam the coefficients are as follows: for copper-nickel thermometers $K=2.6 \times 10^{-14}$ Jxcm²/part; for sensors TVO $K=2.4 \times 10^{-14}$ Jxcm²/part; for sensors "Allen-Bradley" (USA) $K=4.7 \times 10^{-15}$ Jxcm²/part.

47097 **(JINR—10-84-87) Automatic multi-dimensional analyzer based on the SM-3 computer-CAMAC.** Kupchak, R.; Soltan, A.; Skobelev, N.K.; Levitovich, M.; Yankovski, A.; Baluka, G. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions). 1984. 10p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE85702211.

Submitted to the journal Instrum. Exp. Tech. .

Operation and design of a multidimensional multichannel analyzer on the base of the SM-3 computer made in the CAMAC standard are described. The analyzer is intended for data collecting and preliminary processing in studies on the interaction of compound nuclei in correlation experiments with investigation of energy- and angular characteristics of the reaction products. It is possible to determine their 8 parameters where n=1-20. The analyzer operates both in on-line and off-line modes. The block diagram of the algorithm for the automatic system operation and specifications are presented. Experience in the analyzer operation in some physical experiments proves its high serviceability, convenience and reliability in operation.

47098 **(JINR—13-84-386) Fast electronics and digital selection units in the spectrometers of the Laboratory of Neutron Physics.** Bogdzel', A.A.; Tishin, V.G.; Fo Dyk Toan. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics). 1984. 8p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE85702212.

Fast amplifier, two types, discriminator coincidence multiplicity coding unit, perialised crate controller for multi analysis with external buffer memory are described. The specifications black diagrams of the units are presented. The multidetector system for γ-radiation multiplicity measurements are also described.

47099 **(JINR—13-84-387) Fast spectroscopy amplifier.** Bogdzel', A.A.; Fo Dyk Toan. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics). 1984. 3p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE85702213.

The description and technical characteristics of the fast amplifier with passive RC-CR filters are presented. Its maximum amplification is 500, time constants - 10-500 ns. The zero level of output voltage is maitained by switch reestablisher.

47100 **(JINR—13-84-579) Measuring generator for testing spectrometric channels.** Dinh Sy Hien; Kalinkin, A.I. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1984. 6p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE85702214.

A measuring generator for testing and tuning an amplitude spectrometric channel is described. The device consists of a pseudo random pulse generator, constructed on shifters, a sawtooth wave generator and a shaper of stable amplitude pulses with exponential decay times. The device is made as CAMAC unit width modules and has the following specifications: average pulse repetition rate of pseudo random pulses is 3.1; 25; 50; 100; 200 kHz; peak amplitude of 2 Hz pulse repetition of saw tooth pulses is 6 V; peak amplitude of exponential shape pulses is 5 V. The block-diagram and basic circuits of the device are given.

47101 **(JINR—13-84-583) Discriminator with an accurate synchronization for multiwire proportional chamber with delay lines.** Chan, Huu Dao. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1984. 3p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE85702220.

A basic circuit of a discriminator is given. It uses the standard method of "zero crossing' and provides a high accuracy of synchronization. The discriminator is designed for operation with multiwire proportional chambers with delay lines, the edge of input signals being from 25 to 150 ns. The discriminator allows one to operate with a negative input pulse and has the following major parameters: the input impedance is 50 Ω; the input pulse amplitude ranges from 50 mV to 2.0 V; the edge of input pulses is 25 150 ns; the standard output NIM pulse (30 ns duration); the output pulse jitter is 0.52 ns.

47102 **(JINR—16-84-635) $CaSO_4$:Dy; Tm thermoluminophors synthesis technology and their dosimetric characteristics.** Kaskanov, G.Ya.; Henniger, J. (Joint Inst. for Nuclear Research, Dubna (USSR). Dept. of Radiation Safety). 1984. 6p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE85702208.

The aim of the work is to develop and utilize the technology of synthesis of the $CaSO_4$ thermoluminophor activated by Dy or Tm Using the commercial materials of the PA purity. The synthesis technology is described and the following characteristics of the luminophor are given: a) glow curves and the thermal treatment regime; b) sensitivity to the Co-60 gamma-radiation; c) mean value of background luminescence; d) dose characteristics; e) time dependence of fading under laboratory conditions. The presented results are compared with those for analogous TLD-700 luminophors. All the measurements were performed with the 2000(A+B) Harshaw device. The experimentally obtained luminophor characteristics satisfy the requirements of personnel dosimetry and environment monitoring.

47103 (JINR—D-13-84-53, pp 12-18) **Long-term development and comparison of modular systems.** Trekhchinski, R. (Institute of Nuclear Research, Warsaw (Poland)). 1984. (In Russian). NTIS (US Sales Only), PC A20/MF A01. File Number DE85781324. (CONF-8309239—).

From 11. international symposium on nuclear electronics; Bratislava, Czechoslovakia (13 Sep 1983).

Main requirements to developed modular electronics systems used in nuclear physics are reported. There are two main lines: parallel for connections inside the crate and in series for connections between crates. The word length should be 16 bits. Main supply voltage - +5 V. The connectors must contain 96 contacts. In the light of these requirements the CAMAC, VME and AMS systems are considered. Main advantages and drawbacks of these systems are discussed. From enumerated systems VME are shown to be most promising.

47104 (JINR—D-13-84-53, pp 88-91) **Pulse and potential selection units in trigger systems for experimental facilities.** Basiladze, S.G.; Buklej, A.E.; Larichev, A.N.; Kramarenko, V.A.; Smirnov, A.N.; Stepanov, A.N.; Rybnikov, V.M. (Moskovskij Gosudarstvennyj Univ. (USSR)). 1984. (In Russian). NTIS (US Sales Only), PC A20/MF A01. File Number DE85781324. (CONF-8309239—).

From 11. international symposium on nuclear electronics; Bratislava, Czechoslovakia (13 Sep 1983).

Two standard sets of modules for designing fast-response (nanosecond) and pulse potential systems of events selection are briefly described. Pulse selection modules comprise: 8-channel controllable pulse shaper, 5-channel controllable doubled coincidence circuit, controllable doubled delay unit, 8-channel controllable level adapters. Potential selection modules comprise: fast-response selecting register, summing up digit-by-digit converter, fast-response storage device, arithmetic-logic module with the program comparison circuit and module for performing cyclic operations. All the modules are realized in the CAMAC standard.

47105 (JINR—D-13-84-53, pp 113-115) **Spectral signal shaping system with fast counting rates.** Ortlepp, Kh.G. (Technische Univ., Dresden (German Democratic Republic)). 1984. (In Russian). NTIS (US Sales Only), PC A20/MF A01. File Number DE85781324. (CONF-8309239—).

From 11. international symposium on nuclear electronics; Bratislava, Czechoslovakia (13 Sep 1983).

The signal shaping system with fast counting rates applied for measuring fission cross-sections using tandem-accelerators is briefly described. The system comprises preamplifier linear amplifier and selector-integrator. Main characteristics of these elements and their block-diagrams are given. The energy resolution of the system is 1%. The system is tested using neutron fluxes up to 3 x $10^6$ $c^{-1}$. The signal shaping time is 0.25 $\mu$s.

47106 (JINR—D-13-84-53, pp 139-141) **Data coding in a three-dimensional neutron diffraction experiment.** Balagurov, A.M.; Novozhilov, V.E. 1984. (In Russian). NTIS (US Sales Only), PC A20/MF A01. File Number DE85781324. (CONF-8309239—).

From 11. international symposium on nuclear electronics; Bratislava, Czechoslovakia (13 Sep 1983).

The system of data re-coding of read-out from position-sensitive detectors in a three-dimensional neutron diffraction experiment is briefly described. For the realization of the system the method of coordinate conversion of each event from the "laboratory" system into coordinates of crystal back space is applied. Coordinate conversion occurs during data acquisition process. The system consists of three units in the CAMAC standard: time coder unit, wire numbers coding unit and re-coding unit. This system permits data re-coding without losses in data acquisition speed which extends the possibilities of the use of two-coordinate detectors for investigating neutron diffraction on monocrystals.

47107 (JINR—D-13-84-53, pp 146-148) **Hybrid integrated circuits for nuclear electronics.** Yanik, R. (Komenskeho Univ., Bratislava (Czechoslovakia)). 1984. (In Russian). NTIS (US Sales Only), PC A20/MF A01. File Number DE85781324. (CONF-8309239—).

From 11. international symposium on nuclear electronics; Bratislava, Czechoslovakia (13 Sep 1983).

Typical nuclear electronics units realized on hybrid integrated microcircuits are briefly described. Considered are: channel circuit of proportional chambers, TTL-NIM and NIM-TTL level converters, binary and decade counters, set of keys in devices. These circuits are used for measuring ionization radiation parameters.

47108 (JINR—D-13-84-53, pp 175) **Nuclear electronics instruments produced by the Tesla plant, Vrable.** Shkrovina, P. (Tesla, Prague (Czechoslovakia)). 1984. (In Russian). NTIS (US Sales Only), PC A20/MF A01. File Number DE85781324. (CONF-8309239—).

From 11. international symposium on nuclear electronics; Bratislava, Czechoslovakia (13 Sep 1983).

Some nuclear electronics instruments are briefly described. The radiopharmaceutical preparations activity meter is applied for measuring $\gamma$-activity in the 25 keV - 3 MeV energy range. Measurement accuracy is +-6%. The $\gamma$ radiation dose rate meter uses two ionization chambers. The measured dose rate range is 0.1-1000 $\mu$Gy/s, 10 keV - 14 MeV energy range error constitutes 5%. The $\alpha$- and $\beta$-radiation indicator is intended for surface contamination evaluation.

47109 (JINR—D-13-84-53, pp 410-414) **Radio channel application in the network for nuclear-physics researches.** Ofengenden, R.G.; Bunin, S.G.; Vojter, A.P. (AN Ukrainskoj SSR, Kiev. Inst. Yadernykh Issledovanij; AN Ukrainskoj SSR, Kiev. Inst. Kibernetiki). 1984. (In Russian). NTIS (US Sales Only), PC A20/MF A01. File Number DE85781324. (CONF-8309239—).

From 11. international symposium on nuclear electronics; Bratislava, Czechoslovakia (13 Sep 1983).

The development problems of the computer network "Discret", the commutation system of which is based on stack broadcasted radio communication, are reported. The network is created to investigate regional computer network design parameters and provide communication of data acquisition and processing system for nuclear physics researches with a computer centre located at 15 km away. The user 3W transmitters are based on the frequency synthesizer circuit with power amplification receivers according to the superheterodyne with circuit single frequency conversion. Frequency modulation is applied in the network. Reverse time (reception-transmission change-ovea about tens $\mu$s is provided by using the pin-diode circuits. The data transmission rate is up to $10^5$ bits/s. Coverage area is 8 x $10^3$ sq.m. with the transmission validity not worse than $10^{-6}$. The experimental network operation confirmed the correctness of accepted architectural and technological solutions.

47110 (JINR—D-13-84-53, pp 126-128) **4K-ADC for nuclear spectroscopy.** Richter, K.H. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)). 1984. NTIS (US Sales Only), PC A20/MF A01. File Number DE85781324. (CONF-8309239—).

From 11. international symposium on nuclear electronics; Bratislava, Czechoslovakia (13 Sep 1983).

The principle of operation and the method of signal processing in a developed analog-to-digital converter 4K-ADC for a pulse analyzer based on the microcomputes in the CAMAC standard are described. The ADC effect is based on a successive approximate calculation of the channel width by the sliding scale method. The block-diagram and ADC basic characteristics are presented.

47111 (JINR—D-13-84-53, pp 131-135) **CAMAC unit for coincidence multiplicity coding in multisectional detectors.** Bogdzel', A.A.; Tishin, V.G.; Fo Dyk Toan (Joint Inst. for Nuclear Research, Dubna (USSR)); Panteleev, Ts.Ts.; Stancheva, N.S. (Bylgarska Akademiya na Naukite, Sofia. Inst. za Yadrena Izsledvaniya i Yadrena Energetika). 1984. (In Russian). NTIS (US Sales Only), PC A20/MF A01. File Number DE85781324. (CONF-8309239—).

From 11. international symposium on nuclear electronics; Bratislava, Czechoslovakia (13 Sep 1983).

The unit for coincidence multiplicity coding used in an experimental device for investigating $\gamma$ quantum radiation multiplicity in reactions with heavy nuclei at the IRT-2000 and IBR-30 reactors is described. The unit is realized at a shift register in the CAMAC standard and intended for a 32-sectional detector. The results of testing the unit performed at the 12-sectional NaI(Ta) scintillation detector using $^{60}$Co gamma source are presented.

47112 (JINR—D-13-84-53, pp 285-289) **Multidetector spectrometer for neutron and $\gamma$-quantum investigation in heavy nuclei fission.** Bogdzel', A.A.; Gundorin, N.A.; Duka-Zojomi, A.; Kliman, Ya.; Krzhistek, D.; Presperin, V.; Tishin, V.G.; Fo Dyk Toan. 1984. (In Russian). NTIS (US Sales Only), PC A20/MF A01. File Number DE85781324. (CONF-8309239—).

From 11. international symposium on nuclear electronics; Bratislava, Czechoslovakia (13 Sep 1983).

The multidetector spectrometer for emission neutron and $\gamma$-radiation investigation in heavy nuclei fission on the IBR-30 reactor neutron beam is designed. The detector equipment consists of two spectrometric channels which comprise charge-sensitive preamplifiers, spectrometric amplifiers and pulse rise time discriminators (the latter - for the $\gamma$-spectrum quality improving). The equipment comprises Ge(Li) detectors, ionization chamber, liquid scintillator and anticompton module of plastic scintillator, Na(I), crystal and photomultipliers. Data selection is realized by means of the CDC-6500

computer with plotting two-dimensional time-of-flight-energy matrix. The spectra are processed by the PDP-11/70 computer.

47113 (JINR—D-13-84-53, pp 290-292) **Multidetector setup for (n,xnγ) studies at 14 MeV.** Hlavac, S.; Oblozinsky, P.; Horvath, F. (Slovenska Akademia Vied, Bratislava (Czechoslovakia). Fyzikalny Ustav). 1984. NTIS (US Sales Only), PC A20/MF A01. File Number DE85781324. (CONF-8309239—).

From 11. international symposium on nuclear electronics; Bratislava, Czechoslovakia (13 Sep 1983).

The spectrometric device for investigating the neutron and γ-radiation emission is described. The device consists of a neutron and γ-spectrometer using Ge(Li) and NaI(Tl) detectors. In addition, the device contains plastic and liquid scintillators. Data is collected by multichannel analyzers and CAMAC units on the base of the TPA-70/ND-812 computer.

47114 (JINR—D-13-84-53, pp 304-308) **Electronics for small angle scattering facility at the IBR-2 pulse reactor.** Vagov, V.A.; Zhironkin, G.F.; Zhukov, G.P.; Kozlova, E.P.; Korobchenko, M.L.; Kunchenko, A.B.; Ostanevich, Yu.M.; Salamatin, I.M.; Sirotin, A.P. 1984. (In Russian). NTIS (US Sales Only), PC A20/MF A01. File Number DE85781324. (CONF-8309239—).

From 11. international symposium on nuclear electronics; Bratislava, Czechoslovakia (13 Sep 1983).

Electronics of the facility for measuring neutrons low-angle scattering at the IBR-2 reactor is described. The electronics solve the following problems: acquisition storage, visualization, data preliminary processing and output and also experimental equipment monitoring. The experimental equipment comprises 17 $^3$He proportional counters with speed of response not worse than 2.5 μs. The CAMAC electronics is SM-3 mini-computer based.

47115 (JINR—D-13-84-53, pp 49-58) **On-line data reduction and track following in the time projection chamber at DESY.** Stuckenberg, H.J. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). 1984. NTIS (US Sales Only), PC A20/MF A01. File Number DE85781324. (CONF-8309239—).

From 11. international symposium on nuclear electronics; Bratislava, Czechoslovakia (13 Sep 1983).

The track device operation on the base of a drift chamber of the time projection chamber type is described. The restoration of coordinates of particle tracks is ensured with +-0.35 mm accuracy with +-5 ns time resolution at 7 cm μs drift velocity. The amplifier ensures 1% amplitude resolution. The systems of data acquisition, read-out and processing are described.

47116 (JINR—D-13-84-53, pp 59-66) **Vienna contributions for the DELPHI-experiment at LEP CERN.** Pernicka, M. 1984. NTIS (US Sales Only), PC A20/MF A01. File Number DE85781324. (CONF-8309239—).

From 11. international symposium on nuclear electronics; Bratislava, Czechoslovakia (13 Sep 1983).

Main devices of the DELPHI detector planned for using in the LEP storage rings are briefly described. The detector is intended for hadron identification up to 30 GeV. In Vienna drift chambers operating in the streamer mode for muon identification are developed. The chambers are manufactured of plastic material and graphite and filled with gas mixture of argon, isobutane and $CO_2$. The chambers ensure 100 μm spatial resolution. Electronics for measuring drift time ensures 1 ns time resolution at 6-12 ns dead time and is realized in the FASTBUS standard with 32-bit input. The principles of organization of data storage and read-out device in the form of cathode strips are described.

47117 (JINR—D-13-84-53, pp 100-103) **Device for wire tension measurement in multiwire chambers.** Zyazyulya, F.E. (AN Belorusskoj SSR, Minsk. Inst. Fiziki); Korenchenko, S.M.; Smirnov, V.S. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1984. (In Russian). NTIS (US Sales Only), PC A20/MF A01. File Number DE85781324. (CONF-8309239—).

From 11. international symposium on nuclear electronics; Bratislava, Czechoslovakia (13 Sep 1983).

Devices for wire tension measurement in multiwire chambers are considered. Some parameters of measuring devices for chambers with tungsten gilded wires of 20-30 μm diameter, 40-60 cm length at 2 mm pitch with tension up to 80 g. For determining wire tension their natural oscillation frequency is measured. The block-diagram of resonance tensometer ensuring +-1% measurement accuracy and tensometer of shock effect with +-2% measurement accuracy are described. The described devices have shown perfect operating characteristics for a number of years.

47118 (JINR—D-13-84-53, pp 257-261) **Computerized systems for nuclear researches in medium-energy physics.** Ofengenden, R.G. (AN Ukrainskoj SSR, Kiev. Inst. Yadernykh Issledovanij). 1984. (In Russian). NTIS (US Sales Only), PC A20/MF A01. File Number DE85781324. (CONF-8309239—).

From 11. international symposium on nuclear electronics; Bratislava, Czechoslovakia (13 Sep 1983).

Main purposes of the Program of international cooperation of Academies of sciences of socialist countries on automatization of scientific researches for 1979-85 are enumerated. The trends in development of computerized systems for nuclear researches in medium-energy physics based on the CAMAC standard are determined. Typical experimental investigation techniques are enumerated. The structural scheme of one of the most complicated techniques-studying three-particle reactions is considered. The technique variant is presented when at the break-up of two colliding deuterons two protons and a neutron are detected. Protons identification is realized by the time-of-flight method. For protons detecting NaI scintillation detectors are used, neutrons are detected by a liquid scintillator. The methods of subsequent development of nuclear electronics systems are suggested.

47119 (JINR—D-13-84-53, pp 272-276) **Gamma camera system for data acquisition, processing and imaging in the CAMAC standard.** Brzeski, P.; Gajewski, K.; Karolczak, M.; Salwerowicz, M.; Szabatin, R. (Politechnika Warszawska (Poland). Inst. Radioelektroniki). 1984. NTIS (US Sales Only), PC A20/MF A01. File Number DE85781324. (CONF-8309239—).

From 11. international symposium on nuclear electronics; Bratislava, Czechoslovakia (13 Sep 1983).

Gamma camera system for data acquisition and processing used in medicine for cancer diagnosis is developed. The system is designed on the base of MERA 60 minicomputer and CAMAC electronics. The system ensures two-dimensional data readout and displaying. The system is used mainly in common with multiwire proportional chambers.

47120 (JINR—D-13-84-53, pp 281-284) **Fast two-coordinate X-ray detector.** Baru, S.E.; Proviz, G.I.; Savinov, G.A.; Sidorov, V.A.; Khabakhpashev, A.G.; Shekhtman, L.I.; Shuvalov, B.N.; Yasenev, M.V. (AN SSSR, Novosibirsk. Inst. Yadernoj Fiziki). 1984. (In Russian). NTIS (US Sales Only), PC A20/MF A01. File Number DE85781324. (CONF-8309239—).

From 11. international symposium on nuclear electronics; Bratislava, Czechoslovakia (13 Sep 1983).

Fast two-coordinate X-ray detector is developed. The detector is meant for X-ray diffraction investigations and for usage in medicine. The radiation is detected by means of 128 x 128 channel multiwire proportional chamber. Information is red-out from two mutually perpendicular planes. To each pair of cathode wires an amplifier-discriminator coupled with a processor is connected. The coordinate calculation time is equal 70 ns. Resolution time is 20 ns. Monitoring is realized by means of "Electronics-60" computer. For data output a display operating in black-white and coloured modes is developed. The detector electronics consists of three CAMAC crates.

47121 (JINR—D-13-84-53, pp 309-311) **Fluorescent X-ray method for measuring composition and thickness of alloy coatings.** Padee, L. (Politechnika Warszawska (Poland). Inst. Radioelektroniki). 1984. NTIS (US Sales Only), PC A20/MF A01. File Number DE85781324. (CONF-8309239—).

From 11. international symposium on nuclear electronics; Bratislava, Czechoslovakia (13 Sep 1983).

The method of X-ray fluorescence for measuring the composition and thickness of metallic alloy coatings is briefly described. The method comprises relative and absolute tests. At relative tests the parameters of the tested coating are compared with the reference specimens. At the absolute tests the coating parameters are determined according to the mathematical model. The equation for determining the radiation intensity of component elements and algorythm of coating parameters determination is given. The computation time of coating parameters does not exceeds 100 ms. The thickness test error is about +-6%.

47122 (JINR—D-13-84-53, pp 321-322) **Circuits for multielement and cylindrical proportional chambers.** Pleshko, M.; Povinets, P.; Franko, J.; Khudy, M.; Yanik, R. (Komenskeho Univ., Bratislava (Czechoslovakia)). 1984. (In Russian). NTIS (US Sales Only), PC A20/MF A01. File Number DE85781324. (CONF-8309239—).

From 11. international symposium on nuclear electronics; Bratislava, Czechoslovakia (13 Sep 1983).

Electronics connection circuit for multielement and cylindrical chambers meant for measuring $^{3}H$, $^{85}Kr$, $^{133}Xe$ and $^{136}He$ low concentrations are proposed. The detector consists of 19 internal hexahedral elements and 3 layers of multiwire cylindrical counters. To reduce the number of electronics channels the outputs of internal counter elements are linked specially to have only 3 outputs. The counter signals arrive at the preamplifier, discriminator-shapers, logic analysis unit and to the pulse counter. The logic unit and the counters are coupled with the monitoring circuits. The data unit performs events timing.

47123 (JINR—D-13-84-53, pp 42-48) **Trends in development of data aquisition systems in colliding beams experiments.** Guzik, Z. 1984. (In Russian). NTIS (US Sales Only), PC A20/MF A01. File Number DE85781324. (CONF-8309239—).

From 11. international symposium on nuclear electronics; Bratislava, Czechoslovakia (13 Sep 1983).

Main trends in the development of data acquisition systems in colliding beam experiments are stated. The data acquisition is presented in the form of a multilevel process. Each level is characterized by different times of realization and various hardware. At each level the event is subjected to analysis after which a decision is taken on the use of the above event or its exclusion in case the latter being of no interest. The block-diagram of the data acquisition system and main requirements to it are presented. Among them three requirements are noted: the system must record only the events being of interest; data acquisition time must be minimum, data array must not contain redundant information while the recorded data must be packed at a maximum.

47124 (LBL—18909) **Afterpulse time spectra of high-speed photon detectors.** Leskovar, B. (Lawrence Berkeley Lab., CA (USA)). 10 Jan 1985. Contract AC03-76SF00098. 13p. (CONF-850715—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85016631.

From 7. international congress and exhibition on laser optoelectronics; Munich, F.R. Germany (1 Jul 1985).

Recent progress of understanding of the afterpulse time spectra of high-speed photon detectors using photoemission and secondary emission processes is reviewed and summarized. Furthermore, the afterpulse time spectra of high-gain conventionally designed and microchannel plate photon detectors has been investigated. Specifically, the devices studied included RCA 8850, RCA 8854 and ITT F 4129f photomultipliers. Descriptions are given of the measuring techniques. 24 refs., 6 figs., 1 tab.

47125 (MHSMP—85-39) **Specialized instrument for radiation assistance teams.** Applegate, J.A. (Mason and Hanger-Silas Mason Co., Inc., Amarillo, TX (USA)). Aug 1985. Contract AC04-76DP00487. 9p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85017390.

A specialized multiradiation instrument for radiation assistance teams (RAT's) has been designed; a working prototype has been constructed and field tested. The instrument detects alpha, beta, and gamma radiation simultaneously with simple red, yellow, and green meter indications and audio outputs. It is basically intended for DOE radiation assistance teams but would have application to any government, military, or industrial radiation accident team.

47126 (MLM—3287) **Energy response of the De Pangher precision long counter.** Anderson, M.E.; De Pangher, J. (Monsanto Research Corp., Miamisburg, OH (USA). Mound). 28 Aug 1985. Contract AC04-76DP00053. 13p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016980.

The location of the effective center of a long counter is energy dependent and, therefore, the energy response of the counter is a function of both energy and source-detector separation. This report reemphasizes this fact and includes a corrected version of the original energy response curve for the precision long counter.. 13 refs., 2 figs., 1 tab.

47127 (ORNL/TM—9450) **Neutron dosimetry with the ORNL badge.** Berger, C.D.; Lane, B.H. (Oak Ridge National Lab., TN (USA)). Aug 1985. Contract AC05-84OR21400. 18p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85018147.

The ORNL red-dot badge was designed to provide radiation dose estimation for personnel working in neutron, gamma, and mixed-field environments. The primary quantitative radiation-sensing components in the red-dot badge are TLDs, used to measure direct neutron, gamma, and albedo neutron response. The TLDs were calibrated with radium gammas and HPRR-generated neutrons. In this study, the badge is used as a crude spectrometer as well as a dosimeter. Intercomparison results from the Tenth PDIS are favorable, as would be expected since the exposures in the intercomparison were from the same source as the original calibrations. Other neutron- and gamma-emitting sources are being sought in order to confirm the sensitivity of the red-dot badge in a wide range of radiation environments. Whenever possible, dosimeter calibration factors should be determined from independent measurements of neutron spectral quality.

47128 (PTB-Dos—11) **Conversion factors for the ICRU dose equivalent quantities for calibrating radiation dosemeters.** Grosswendt, B.; Hohlfeld, K.; Kramer, H.M.; Selbach, H.J. (Physikalisch-Technische Bundesanstalt, Braunschweig (Germany, F.R.). Gruppe Photonen- und Elektronendosimetrie). Feb 1985. 24p. (In German). B. File Number DE85752249.

Report describing the application of conversion factors for monoenergetic photon radiation and for X and gamma reference radiation used for dosemeter calibration with the aid of spherical or rectangular phantoms (environmental and individual monitoring).

47129 (RISO-R—507) **Experimental investigation of the suitability of the track structure theory in describing the relative effectiveness of high-let irradiation of physical radiation detectors.** Hansen, J.W. (Risoe National Lab., Roskilde (Denmark)). Nov 1984. 504p. NTIS (US Sales Only), PC A22/MF A01. File Number DE85702210.

The radiation effectiveness of heavy charged particles relative to radiations of fast electrons, x-rays, and gamma rays has been studied experimentally as well as theoretically for detectors of a thin nylon-based radiation-sensitive film and for the amino acid alanine. Experimental data have been compared with calculated data derived from a theoretical model describing the track structure of heavy charged particles. The experimental work comprises dose-response characteristics from $^{60}Co$ $\gamma$-rays, 4- and 16-MV x-rays, 6-,10-, and 20-MeV electrons, and 3-, 6-, and 16-MeV protons, 10- and 20-MeV $\alpha$-particles, 21-MeV $^{7}Li$ ions, 42-MeV $^{14}N$ ions, 64-MeV $^{16}O$ ions, and 80-MeV $^{32}S$ ions. The theoretical work presented here concerns an investigation and modification of parameters involved in the calculations, based on results obtained through the present experiments and published results from other investigators. This report summarizes results already published or accepted for publication, attaches an appendix, and includes results not previously presented.

47130 **X-ray calibration of Kodak Direct Exposure film.** Brown, D.B.; Burkhalter, P.G.; Rockett, P.D.; Bird, C.R.; Hailey, C.J.; Sullivan, D. (U.S. Naval Research Laboratory, Washington, D.C.20375). *Applied Optics;* 24: No. 16, 2536-2542(15 Aug 1985). Contract AC08-82DP40152.

Kodak Direct Exposure film (DEF) has replaced Kodak No-Screen film for use in x-ray diffraction analysis and in autoradiography. DEF is a double-emulsion film which has been found to have improved radio-graphic characteristics over No-Screen. A set of H-D curves has been generated for DEF at five photon energies: 0.930, 1.49, 1.74, 4.51/4.93, and 6.93 keV. The KMSF x-ray calibration facility was utilized to study the absolute sensitivity of this film over its full dynamic range. Physical examination of the film was followed by theoretical modeling, which adequately reproduced the measured curves.

47131 **Portal radiation monitor.** Kruse, L. W. (to The United States of America as represented by the United States Department of Energy). US Patent 4,509,042. 2 Apr 1985. Filed date 23 Mar 1982. vp.

PAT-APPL-361152.

A portal radiation monitor combines 0.1% FAR with high sensitivity to special nuclear material. The monitor utilizes pulse shape discrimination, dynamic compression of the photomultiplier output and scintillators sized to maintain efficiency over the entire portal area.

47132 **Tritium monitor with improved gamma-ray discrimination.** Cox, S. A.; Bennett, E. F.; Yule, Th. J. (to The United States of America as represented by the United States Department of Energy). US Patent 4,504,737. 12 Mar 1985. Filed date 21 Oct 1982. vp.

PAT-APPL-435795.

Apparatus and method for selective measurement of tritium oxide in an environment which may include other radioactive components and gamma radiation, the measurement including the selective separation of tritium oxide from a sample gas through a membrane into a counting gas, the generation of electrical pulses individually representative by rise times of tritium oxide and other radioactivity in the counting gas, separation of the pulses by rise times, and counting of those pulses representative of tritium oxide. The invention further includes the separate measurement of any tritium in the sample gas by oxidizing the tritium to tritium oxide and carrying out a second separation and analysis procedure as described above.

## 4402 Radiation Effects On Instrument Components, Instruments, Or Electronic Systems

47133 **(SAND—85-0546C) Transient two-dimensional simulation of a cosmic event on a CMOS SRAM cell.** Fu, J.S.; Axness, C.L.; Weaver, H.T. (Sandia National Labs., Albuquerque, NM (USA)). 1985. Contract AC04-76DP00789. 6p. (CONF-8505185—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85008210.

From 1. international symposium on VLSI technology, systems, and applications; Taipei, Taiwan, China (8 May 1985).

Two-dimensional transient simulations of cosmic ion strikes on sensitive junctions of a CMOS SRAM have been carried out. The calculations determine time responses for transport variables of the four cross-coupled transistors and reveal the conditions for change of state or upset. 6 refs., 6 figs., 1 tab.

47134 **(SAND—85-0691C) Optoelectronic data link designed for applications in a radiation environment.** Wiczer, J.J.; Barnes, C.E. (Sandia National Labs., Albuquerque, NM (USA)). 1985. Contract AC04-76DP00789. 9p. (CONF-850711—13). NTIS, PC A02/MF A01; GPO Dep. File Number DE85017117.

From 22. annual conference on nuclear and space radiation effects; Monterey, CA, USA (22 Jul 1985).

We report here on component and systems studies of a 10 m long, optoelectronic data transmission link designed for operation in a radiation environment. Our results show good immunity to neutron fluence levels of approximately 2 x $10^{14}$ neutrons/cm$^2$ and gamma radiation levels of $10^7$ rad (Si). These results suggest that radiation hardened optoelectronic data links can be designed to operate in severe environments by carefully selecting components from the existing optoelectronics technology base. 6 refs., 4 figs.

47135 **(SAND—85-0723C) Qualification of radiation-hard dielectrics for capacitor applications.** Kurtz, S.R.; Arnold, C. Jr.; Edwards, L.R. (Sandia National Labs., Albuquerque, NM (USA)). 1985. Contract AC04-76DP00789. 13p. (CONF-8510114—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85014640.

From Conference on electrical insulation and dielectrics; Amherst, NY, USA (21 Oct 1985).

Specific polymer dielectric materials have been identified that can be used to minimize the discharge of capacitors upon exposure to ionizing radiation. The testing procedures used to qualify the radiation-induced conductivity in capacitor dielectrics are discussed, and a comparison is made of various "radiation-hard" dielectrics that display low levels of radiation-induced conductivity.

## 4403 Miscellaneous Instruments

*REFER ALSO TO CITATION(S) 46241, 46969, 46977, 47130, 47890*

47136 **(CONF-8405340—1-Draft) Methods of calibration at a National Laboratory. Draft.** Anderson, R.L. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 21p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85016401.

From Symposium on applications of radiation thermometry; Gaithersburg, MD, USA (8 May 1984).

Laboratory and Division quality assurance procedures require that measurements of essential data be traceable to NBS. At ORNL this traceability is provided through the calibration services of Metrology Research and Development Laboratory (MRDL). In particular, the temperature and electrical standards for optical pyrometers are maintained in MRDL through calibrations, a systematic record system, and a computerized maintenance and calibration recall system. For many instruments, we have calibration records going back more than 20 years. During that time, the Maintenance Information System has evolved an effective set of tools for ensuring the traceability and quality of measurements. These include the instrument identification numbering system, the service and calibration system, and the instrument status and recall system. In many cases the instruments have outlived the researchers or custodians of the instruments, and the Maintenance Information System records provided a continuous record for the new personnel who inherit them. 9 figs.

47137 **(DOE/MC/10761—1880) Field test report: on-line test of SIMP-III, particulate/gas analyzer at Morgantown Energy Technology Center, Morgantown, West Virginia.** Brackmann, R.T.; Fite, W.L. (Extranuclear Labs., Inc., Pittsburgh, PA (USA)). Dec 1981. Contract AC21-79MC10761. 18p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85013679.

The SIMP-III is a particulate/Gas Analyzer incorporating a quadrupole mass analyzer with provision for both electron impact ionization of gases and surface ionization of particulates. It samples gas from near atmospheric pressure, passes the gas through a prechamber, where the pressure is dropped to about 1 torr, and then into a first vacuum chamber, where the pressure is maintained at about $10^{-4}$ torr. It is in the first chamber that the ionization occurs. Ions formed in the first chamber are electrostatically focussed through an aperture and enter a second chamber where the pressure is reduced further and where mass separations of the ions are made by a quadrupole mass filter.

47138 **(EGG—10282-2062) Picosecond semiconductor lasers for characterizing high-speed image shutters.** Pagano, T.S.; Janson, F.J.; Yates, G.J.; Jaramillo, S.A. (EG and G, Inc., Goleta, CA (USA); Los Alamos National Lab., NM (USA)). 1985. Contract AC08-83NV10282. 7p. (CONF-850887—22). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85016567.

From SPIE international technical symposium on optical and electro-optical engineers; San Diego, CA, USA (18 Aug 1985).

A portable system that utilizes solid state electronic timing circuits and a pulsed semiconductor laser for characterizing the optical gate sequence of high-speed image shutters, including microchannel-plate intensifier tubes (MCPTs), and silicon-intensifier target vidicons (SITVs), is described and compared to earlier methods of characterization. Gate sequences obtained using the systems and streak camera data of the semiconductor laser pulse are presented, with a brief discussion of the electronic delay timing and avalanche circuits used in the system.

47139 (EGG/10282—1057, pp 11.1-11.14) **Acquisition procedures and equipment for surveys requiring the inframetrics thermal infrared imaging system.** Shines, J.E. (EG and G Energy Measurements Inc., Las Vegas, NV). Jan 1985. NTIS, PC A19/MF A01. File Number DE85010212. (CONF-830286—).

From Symposium on remote sensing technology; Las Vegas, NV, USA (23 Feb 1983).

The Inframetrics Model 210 thermal infrared imaging system has been used in several remote sensing surveys to acquire thermal imaging during ground-based experiments. A description of the system's components and specifications, and the methodology of acquisition as it applied to the Liquified Gaseous Fuels (LGF) tests conducted at the Naval Weapons Center (NWC) at China Lake, California, are presented. Because the imager simultaneously records data in two infrared bands, two thermal aspects of an experiment can be optimally monitored. The video output is recorded in the original analogue format and can be replayed for post-event reviewing. By digitizing the analogue frames, the imagery data can be analyzed and processed using the Interactive Digital Image Manipulation System (IDIMS) to produce color imagery and statistical data in various forms of output.

47140 (EGG/10282—1057, pp 13.1-13.11) **Imaging streak camera systems.** Black, J.P. (EG and G Energy Measurements Inc., Los Alamos, NM). Jan 1985. NTIS, PC A19/MF A01. File Number DE85010212. (CONF-830286—).

From Symposium on remote sensing technology; Las Vegas, NV, USA (23 Feb 1983).

Streak cameras have been used for high-bandwidth, high-sensitivity optical radiation detection for years. Recently, streak systems with the ability to record multichannel/image data for later image processing reconstruction have been designed and fielded. The hardware involved in these cameras will be described, and sample data for calibration of such systems will be included.

47141 (EGG/10282—1057, pp 15.1-15.15) **Flight testing of two laser based fluorosensor systems.** Capelle, G.A.; Franks, L.A.; Jessup, D.A. (EG and G Energy Measurements Inc., Santa Barbara, CA). Jan 1985. NTIS, PC A19/MF A01. File Number DE85010212. (CONF-830286—).

From Symposium on remote sensing technology; Las Vegas, NV, USA (23 Feb 1983).

Results of flight tests of two laser-based fluorosensors designed for remotely monitoring potential effluents from coal processing facilities are summarized. One system employed a 3 mj/pulse N2 laser (337 nm) for excitation with an 8-inch f/4.5 Newtonian telescope-photomultiplier combination as a receiver. The system was operated with a single spectral channel in the region of 400 nm. A second system, using the same telescope, employed a 250 mf/pulse KrF laser (249 nm) and operated with two spectral channels centered at 390 nm and 290 nm. Both systems were operated from the DOE/EG and G Convair 580-T aircraft. The N2 system was tested under nighttime, twilight, and early morning background light levels at altitudes from 300 to 1000 feet over targets fabricated at NTS. Strong signals with high signal-to-noise ratios were recorded during low solar background periods, but detectivity was reduced with increasing background. The KrF system was tested under similar background conditions over targets at NTS, the Naval Petroleum Reserve, and the Santa Barbara Channel. Strong signals were received under all background conditions at altitudes up to 2000 feet. Based on these tests, minimum detectable concentrations are estimated for a number of substances.

47142 (EGG/10282—1057, pp 16.1-16.12) **Survey of EG and G aerial photographic systems.** McCreary, T. (EG and G Energy Measurements Inc., Las Vegas, NV). Jan 1985. NTIS, PC A19/MF A01. File Number DE85010212. (CONF-830286—).

From Symposium on remote sensing technology; Las Vegas, NV, USA (23 Feb 1983).

EG and G/EM utilizes three primary photographic systems for the acquisition of aerial imagery. Large format framing cameras are used for direct vertical photography. Clusters of medium format framing cameras are used for multispectral photography. A large format hand-held camera is used for oblique photography. All cameras can be fitted with a variety of lenses. A modern photographic laboratory is used to develop all aerial films and produce various photographic end products in a variety of sizes.

47143 (EGG/10282—1057, pp 17.1-17.12) **Image analysis facility siting: a comparison of low- and high-altitude image interpretability for land use/land cover mapping.** Borella, H.M.; Estes, J.E.; Ezra, C.E.; Scepan, J.; Tinney, L.R. (EG and G Energy Measurements Inc., Santa Barbara, CA). Jan 1985. NTIS, PC A19/MF A01. File Number DE85010212. (CONF-830286—).

From Symposium on remote sensing technology; Las Vegas, NV, USA (23 Feb 1983).

This study documents for two test sites in Pennsylvania the interpretability of commercially acquired low-altitude and existing high-altitude aerial photography in terms of time, costs, and accuracy for Anderson Level II land use/land cover mapping. Information extracted from the imagery is to be used in the evaluation process for siting energy facilities.

47144 (EGG/10282—1057, pp 25.1-25.7) **Digital vacuum monitoring system for remote sensing of vacuum level.** Jacoby, K.D. (EG and G Energy Measurements Inc., San Ramon, CA). Jan 1985. NTIS, PC A19/MF A01. File Number DE85010212. (CONF-830286—).

From Symposium on remote sensing technology; Las Vegas, NV, USA (23 Feb 1983).

A digital technique for remote vacuum sensing in the range of $10^{-3}$ to $10^{3}$ torr is achieved by a system composed to two chassis: a Remote Gauge Box and a Gauge Controller. Together, these two chassis comprise the Digital Vacuum Monitor System (DVMS). A remote Gauge Box provides excitation power, signal conditioning, and FM encoding for up to two pressure transducers. Currently, a Granville-Phillips GP-275 thermal conductivity sensor and/or a Sparton-Southwest type 401.100 variable resistance pressure sensor can be deployed with the Remote Gauge Box. The power to the unit is provided from a Gauge Controller via the same coaxial cable which carries the encoded data. The Gauge Controller is capable of providing d-c power for four Remote Gauge Boxes or up to eight transducers. It selectively displays one of the eight incoming frequencies, counts and converts the incoming signal to a direct physical readout on an alphanumeric LED display, and provides an analog output for recording, using a digital-to-analog converter. Both the digital and analog outputs are converted through the use of a lookup table provided by four electrically programmable read-only-memories (EPROM) which reside in the Gauge Controller chassis. The primary intent of the DVMS is to provide remote sensing of vacuum level in the range of $10^{-3}$ torr to $10^{3}$ torr. However, by modifying the Remote Gauge Box and by replacement of the existing EPROM with an appropriate file, any desired transducer can be utilized with the DVMS.

47145 (EGG/10282—1057, pp 31.1-31.23) **Analytical capabilities of the multispectral remote sensing department.** Logan, C.W.; Smith, D.B. (EG and G Energy Measurements Inc., Las Vegas, NV). Jan 1985. NTIS, PC A19/MF A01. File Number DE85010212. (CONF-830286—).

From Symposium on remote sensing technology; Las Vegas, NV, USA (23 Feb 1983).

This section presents an overview of the capabilities and limitations of the software and hardware in the Multispectral Remote Sensing Department. The following topics are included: (1) Interactive Digital Image Manipulation System (IDIMS) software; (2) extensions to IDIMS; (3) preprocessing software; (4) image digitizing

software; (5) HP-3000 computer system hardware, including image display processors, film output devices, and array processor; and (6) PDP-11/60 computer system hardware, including microdensitometer and video digitizer.

47146 (INIS-mf—9351, pp 661-666) **Construction of a R.F. mass spectrometer for high precision mass-measurements.** Coc, A.; Fergeau, R.; Thibault, C.; Audi, G.; Epherre, M.; Guimbal, P.; Saint Simon, M. de; Touchard, F. (Centre National de la Recherche Scientifique, 91 - Orsay (France). Lab. Rene Bernas); Haebel, E.; Herr, H. 1984. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781594. (CONF-8409143—).

From 7. international conference on atomic masses and fundamental constants (AMCO-7); Darmstadt-Seeheim, F.R. Germany (3 Sep 1984).

We are presently building a radiofrequency mass spectrometer based on the same principle as the one built by L.G. Smith about 20 years ago. We expect a 500,000 resolving power together with a reasonable transmission (proportional $10^{-4}$). The parameters which influence the resolving power are shown. The present status of the construction is presented. (orig./HSI).

47147 (INIS-mf—9351, pp 667-671) **High-resolution high-transmission mass spectrometer.** Matsuda, H. (Osaka Univ., Toyonaka (Japan). Inst. of Physics). 1984. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781594. (CONF-8409143—).

From 7. international conference on atomic masses and fundamental constants (AMCO-7); Darmstadt-Seeheim, F.R. Germany (3 Sep 1984).

A double focusing mass spectrometer with the field arrangement of QQHQC (Quadrupole, Quadrupole, Homogeneous magnetic sector, Quadrupole, Cylindrical electric sector) is described. The distinguishing features are: wide angle focusing through a narrow magnet gap, very small image magnification which leads to high resolution without decreasing ion intensity, and sufficiently small second and third order aberrations. (orig.).

47148 (INIS-mf—9351, pp 672-678) **Computer program 'TRIO FIT' for design of a high performance mass spectrometer.** Matsuo, T.; Matsuda, H. (Osaka Univ., Toyonaka (Japan). Inst. of Physics). 1984. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781594. (CONF-8409143—).

From 7. international conference on atomic masses and fundamental constants (AMCO-7); Darmstadt-Seeheim, F.R. Germany (3 Sep 1984).

In this paper we explain the general procedure for designing a new mass spectrometer with the aid of the computer program TRIO-FIT. (orig./HSI).

47149 (INIS-mf—9351, pp 679-683) **GIOS-BEAM-TRACE, a program for the design of high resolution mass spectrometers.** Wollnik, H.; Brezina, J.; Berz, M.; Wendel, W. (Giessen Univ. (Germany, F.R.). 2. Physikalisches Inst.). 1984. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781594. (CONF-8409143—).

From 7. international conference on atomic masses and fundamental constants (AMCO-7); Darmstadt-Seeheim, F.R. Germany (3 Sep 1984).

GIOS is a computer code which offers help during the design of a particle spectrometer or a beam guidance system. It determines algebraically the transfer matrices of all magnetic and electrostatic optical elements involved and derives the overall properties of the system under investigation numericallly by matrix multiplication. Furthermore it varies marked parameters of the system iteratively so that postulated conditions are fulfilled. For this purpose GIOS uses either the "simplex method" or the "method of conjugated gradients". (orig./HSI).

47150 (INIS-mf—9351, pp 684-688) **High-precision direct mass determination of short-lived isotopes confined in a Penning trap.** Dabkiewicz, P.; Kalinowski, H.; Kern, F.; Kluge, H.J.; Schweikhard, L.; Schnatz, H.; Stuermer, H. (Mainz Univ. (Germany, F.R.). Inst. fuer Physik); Moore, R.B. (McGill Univ., Montreal, Quebec (Canada). Foster Radiation Lab.). 1984. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781594. (CONF-8409143—).

From 7. international conference on atomic masses and fundamental constants (AMCO-7); Darmstadt-Seeheim, F.R. Germany (3 Sep 1984).

The basic idea of the experiment is to determine the mass of an isotope directly by measurements of its cyclotron frequency in a known magnetic field, while the isotope is stored in a Penning trap. (orig./HSI).

47151 (INIS-mf—9351, pp 689-695) **Time-of-flight isochronous (TOFI) spectrometer for direct mass measurements of exotic light nuclei.** Wouters, J.M.; Vieira, D.J.; Wollnik, H.; Butler, G.W. (Los Alamos National Lab., NM (USA). Isotope and Nuclear Chemistry Div.). 1984. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781594. (CONF-8409143—).

From 7. international conference on atomic masses and fundamental constants (AMCO-7); Darmstadt-Seeheim, F.R. Germany (3 Sep 1984).

This paper presents a brief review of the nuclear physics interests in the low Z neutron-rich region as well as a description of the TOFI spectrometer now under construction. (orig./HSI).

47152 (INIS-mf—9652, pp 34) **Fibre-optical sensors.** Ulrich, R. (Hamburg Univ. (Germany, F.R.)). 1984. (In German). NTIS (US Sales Only), PC A07/MF A01. File Number DE85781476. (CONF-8409235—Summ.).

From Annual meeting of the Austrian Physical Society; Leoben, Austria (24 Sep 1984).

Published in summary form only.

47153 (INIS-mf—9652, pp 30) **Point contact spectroscopy.** Wyder, P. 1984. (In German). NTIS (US Sales Only), PC A07/MF A01. File Number DE85781476. (CONF-8409235—Summ.).

From Annual meeting of the Austrian Physical Society; Leoben, Austria (24 Sep 1984).

Published in summary form only.

47154 (INIS-mf—9652, pp 59) **Applicability of the hoe method to the determination of spatial distributions in metal plasmas.** Neger, T.; Jaeger, H. (Technische Univ., Graz (Austria)). 1984. (In German). NTIS (US Sales Only), PC A07/MF A01. File Number DE85781476. (CONF-8409235—Summ.).

From Annual meeting of the Austrian Physical Society; Leoben, Austria (24 Sep 1984).

Published in summary form only.

47155 (INIS-mf—9652, pp 60) **Suitability of the melting plateau of high melting metals as a secondary temperature standard above the gold point.** Jaeger, H.; Pottlacher, G. (Technische Univ., Graz (Austria)). 1984. (In German). NTIS (US Sales Only), PC A07/MF A01. File Number DE85781476. (CONF-8409235—Summ.).

From Annual meeting of the Austrian Physical Society; Leoben, Austria (24 Sep 1984).

Published in summary form only.

47156 (INIS-mf—9742, pp 84-89) **Design of Densitron 4 modular digital image analyzer.** Birkholz, W.; Steinert, M.; Freyer, K. (Akademie der Wissenschaften der DDR, Leipzig. Zentralinstitut fuer Isotopen- und Strahlenforschung). 1983. (In German). NTIS (US Sales Only), PC A12/MF A01. File Number DE85781598. (CONF-8305206—).

From 13. international symposium on autoradiography; Tabor, Czechoslovakia (2 May 1983).

On the basis of experience with the AURAS system the concept has been designed of a new modular digital instrument for the evaluation of images - the Densitron 4. It consists of an optical signal recorder, an analog-to-digital converter, a colour display unit and a control and processing microcomputer unit with corresponding peripherals. The requirements are specified for software which will control the data flow between the individual modules and will allow the evaluation of images in the dialogue regime. Further processing of results will be possible if a more powerful computer is used, in either on-line or off-line operation. (Ha).

47157 (JINR—D-13-84-53, pp 277-280) **Microprocessor system for data acquisition processing and display for Auger electrons spectrometer.** Pawlowski, Z.; Cudny, W.; Hildebrandt, S.; Marzec, J.; Walentek, J.; Zaremba, K. (Politechnika Warszawska (Poland). Inst. Radioelektroniki). 1984. NTIS (US Sales Only), PC A20/MF A01. File Number DE85781324. (CONF-8309239—).

From 11. international symposium on nuclear electronics; Bratislava, Czechoslovakia (13 Sep 1983).

Data acquisition system for Auger electron spectrometry is developed. The system is used for chemical and structural analysis of materials and consists of a cylindrical mirror analyzer being a measuring spectrometer device, CAMAC unit and control unit. The control unit comprises a microcomputer based on INTEL 8080 microprocessor and display.

47158 (JINR—D-13-84-53, pp 176-178) **Sectional microprocessor based microcomputer and its application to express analysis using interactive language.** Lang, I.; Leveleki, L.; Salai, M.; Turani, D. (Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics). 1984. (In Russian). NTIS (US Sales Only), PC A20/MF A01. File Number DE85781324. (CONF-8309239—).

From 11. international symposium on nuclear electronics; Bratislava, Czechoslovakia (13 Sep 1983).

Sectional microprocessor TPA-L/128H based mini-computer being a part of the TPA-8 computer family is developed. A substantial increase of the computer operation rate is attained at the expense of microprogram monitoring. The central processor is constructed on the base of the AM2900 sectional microprocessor elements. The TPA-L/128H computer is program compatible with TPA-8 computer, perfectly equipped with software: high level languages as well as OS/L, COS/H, RTS/H, PAL/128, WPS, TEASYS-8 and IL 128 ensuring statistical data processing, physical experiments automation and interactive experimental data processing. The real time basis problems and CAMAC devices monitoring are efficiently solved.

47159 (LA-UR—85-2510) **VISAR: interferometer quadrature signal recording by electronic streak camera.** Hemsing, W.F. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 8p. (CONF-850706—30). NTIS, PC A02/MF A01; GPO Dep. File Number DE85015701.

From 8. international symposium on detonation; Albuquerque, NM, USA (15 Jul 1985).

This short paper describes a demonstration to record the four quadrature signals from a push-pull VISAR velocity interferometer using an electronic streak camera. Optical fibers were used to transmit the interferometer outputs to the camera photocathode. Brightness variations of these signals were recorded on film during the experiment. Velocity information was later recovered from this record to give a continuous velocity history. Anticipated advantages over previous methods are increased time resolution, the ability to record multiple velocities simultaneously and greater dynamic range. 13 refs., 4 figs.

47160 (MLM—3285(OP)) **Effects of operating environment on performance of radiometric calorimeters.** Mayer, R.L. II. (Monsanto Research Corp., Miamisburg, OH (USA). Mound). 1985. Contract AC04-76DP00053. 7p. (CONF-850765—27). NTIS, PC A02/MF A01; GPO Dep. File Number DE85016446.

From 26. annual meeting of the Institute of Nuclear Materials Management; Albuquerque, NM, USA (21 Jul 1985).

An experimental program was conducted to assess the effects of changes in operating environment on calorimeter performance. An environmental chamber was used to permit bath temperature stability, room temperature stability, room humidity, and the humidity to which the calorimeter's sample chamber is exposed to be varied independently of one another. The resulting effects on the mean and standard deviation of the error for standard measurements were studied. The results of analysis indicated that the interaction of bath and room temperature stability has a significant effect on error standard deviation, while the humidity to which the sample chamber is exposed most significantly affects mean error. This information can be used as part of a measurement assurance program by checking the product of bath and room temperature stability for significant changes with each sample measurement, and by checking for major shifts in humidity to which the sample chamber is exposed. 12 figs., 4 tabs.

47161 (SAND—85-0354C) **Electro-optical Kerr effect voltage measurements on multi-megavolt pulsed power accelerators.** Allen, G.R.; Davis, H.P.; Neyer, B.T.; Muron, D.J.; Chang, J.; Hebner, R.E. (Sandia National Labs., Albuquerque, NM (USA); National Bureau of Standards, Washington, DC (USA)). 1985. Contract AC04-76DP00789. 4p. (CONF-850887—23). NTIS, PC A02/MF A01; GPO Dep. File Number DE85016580.

From SPIE international technical symposium on optical and electro-optical engineers; San Diego, CA, USA (18 Aug 1985).

We have developed a highly accurate, non-perturbing, non-invasive voltage monitor for multi-megavolt measurements in water using the electro-optic Kerr effect. The strong electric field causes the normally isotropic water to become linearly birefringent, with the birefringence axis aligned along the field. A beam polarized at 45° with respect to the electric field will experience a phase difference in the parallel and perpendicular components by an amount proportional to the square of the electric field. Measuring the phase change gives an accurate and precise value of the electric field.

47162 (SAND—85-1807C) **Discussion on the Vibration Process Standards 9958002 and 9958004.** Cericola, F. (Sandia National Labs., Albuquerque, NM (USA)). 1985. Contract AC04-76DP00789. 6p. (CONF-8506117—3). NTIS, PC A02/MF A01; GPO Dep. File Number DE85017116.

From 41. meeting of the IMOG subgroup on environmental testing; Miamisburg, OH, USA (18 Jun 1985).

The Vibration Process Standards 9958002 and 9958004 are Sandia documents that cover the requirements of sinusoidal and random vibration testing with respect to instrumentation, calibration equipment capability and test methods. A six-month calibration procedure for random vibration digital signal analyzers has been developed, and changes are proposed to the six-month waveform distortion survey required by the standards. (LEW)

47163 (SERI/TP—255-2771) **Integrating sphere spectrometer for high-temperature materials characterization.** Masterson, K.D.; Jorgensen, G.J.; Burrows, R.W.; Schissel, P. (Solar Energy Research Inst., Golden, CO (USA)). Aug 1985. Contract AC02-83CH10093. 12p. (CONF-850887—25). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85012170.

From SPIE international technical symposium on optical and electro-optical engineers; San Diego, CA, USA (18 Aug 1985).

A state-of-the-art, high-temperature integrating sphere spectrometer has been fabricated and characterized. The liquid-cooled sphere is combined with a furnace designed for a maximum specimen temperature of 1200°C. The spectrometer is capable of measuring the spectral, diffuse, and hemispherical reflectance and transmittance over the wavelength range of 0.35 to 2.5 micrometers. Chopped white light from a high pressure xenon arc-lamp is introduced into the sphere, alternately reflected from the sphere wall and reflected from or transmitted through the specimen, spectrally resolved by a monochromator, and focused onto a two-color Si/PbS detector. Data are sampled at wavelengths corresponding to equal energy bands of the terrestrial solar distribution and are graphically displayed. Data acquisition and hardware module commands are computer controlled. The sphere and light collecting optics can be rotated about the horizontal optical axis of the monochromator so that the specimen port is at the top (0°), side (90°),

or bottom (180°) of the sphere. This allows optical characterization of a variety of materials relevant to high-temperature solar energy applications to be carried out by rotating the instrument into a desired orientation. For example, in the 0° ("loop up" at the sample) position, reflectance and transmittance of molten salt in a furnace-heated cell can be measured without salt vapor entering the sphere. At 90°, a vertical wall of falling sand particles can be characterized. In the 180° ("look down") position, the optical properties of solids such as ceramics, metal alloys, or powders can be ascertained.

47164 **(UCRL—92198) Coupling between plastic scintillators and light fibers for remote detection of x-rays.** Perry, T.S.; Molitoris, J.J. (Lawrence Livermore National Lab., CA (USA)). 18 Jul 1985. Contract W-7405-ENG-48. 6p. (CONF-850887—20). NTIS, PC A02/MF A01; GPO Dep. File Number DE85016946.

From SPIE international technical symposium on optical and electro-optical engineers; San Diego, CA, USA (18 Aug 1985).

Plastic scintillators can be coupled to light fibers to make small, simple, and inexpensive x-ray detectors. These detectors have been developed for use at the Nevada Test Site (NTS) for the remote detection of x-rays. Light produced in the scintillator can be transmitted by the fiber for several hundred meters to a photodetector, which is usually a streak camera or a photomultiplier tube. The use of a streak camera allows many channels to be recorded simultaneously. A parameter study has been done to measure the sensitivity of these detectors as a function of scintillator geometry, type of scintillator, coupling geometry, and x-ray energy. The results can be qualitatively explained by simple geometric theory. A recent use of these detectors at NTS was the measurement of an x-ray spectrum. System performance for this measurement will be reviewed. 7 refs., 5 figs., 1 tab.

47165 **Photocurrent multiplication in ion implanted lateral In/sub 0.2/Ga/sub 0.8/As/GaAs strained-layer superlattice photodetectors.** Bulman, G.E.; Myers, D.R.; Zipperian, T.E.; Dawson, L.R.; Wiczer, J.J.; Biefeld, R.M. (Sandia National Laboratories, Albuquerque, New Mexico 87185). *Applied Physics Letters;* **47**: No. 7, 733-735(1 Oct 1985). Contract AC04-76DP00789.

We demonstrate the first $Be^+$-implanted lateral In/sub 0.2/Ga/sub 0.8/As/GaAs strained-layer superlattice (SLS) avalanche photodetector. This planar device exhibits low capacitance (<1 pF), low dark current (less than 6 nA at -60 V), and large active area (100 μm x 250 μm at -50 V). In addition, an uncoated external quantum efficiency of 50% at -50 V between 775 and 880 nm is observed with response continuing to 1.03 μm. Detailed photocurrent measurements confirm the occurrence of photocurrent multiplication and indicate that the ionization coefficient of electrons is larger than that of holes for transport in the plane of the SLS. This work demonstrates the advantages of exploiting the preferred transport direction that occurs in superlattice structures through the use of ion implantation.

47166 **Photonic methods of high-speed analog data recording.** Chang, J.; Filter, W.F.; Lockwood, G.J.; Neyer, B.T. (Sandia National Laboratories, Albuquerque, New Mexico 87185). *Review of Scientific Instruments;* **56**: No. 10, 1861-1866(Oct 1985). Contract AC04-76DP00789.

We have developed a photonic high-speed analog data recording system that, when compared with conventional oscilloscope-based systems, offers greater economy, higher bandwidth, electrical isolation, and compactness. The basis of this approach is to record analog photonic signals rather than analog electrical signals. A key component is the prototype high-speed multi- channel data recorder. Initial demonstrations of this photonic system in pulsed power experiments have already shown its versatility and usefulness. We describe the system and its integration with newly developed photonic sensors and discuss its overall impact in diagnostic technology.

47167 **Quantum-ferroelectric pressure sensor for use at low temperatures.** Lawless, W.N.; Clark, C.F.; Samara, G.A. (CeramPhysics, Inc., Westerville, Ohio 43081). *Review of Scientific Instruments;* **56**: No. 10, 1913-1916(Oct 1985). Contract AC04-76DP00789.

A small, multilayer capacitance sensor (~ 70 $mm^3$) for measuring pressure over a broad range at low temperatures is described. The dielectric material is a quantum ferroelectric in the $(Cd, Pb)_2(Nb, Ta)_2 O_7$ ceramic system, and the reciprocal capacitance varies linearly with pressure into the kilobar region. The average sensitivity of the devices studied is 151 pF/kbar, and the sensor is essentially independent of both intense magnetic fields and temperature below 10 K. A calibration for the slight magnetic field effect is given, and the sensor is dielectrically stable at helium temperatures. A one-point pressure calibration is estimated to be reliable to <+-0.1%, and pressure changes in the millibar range can be resolved if certain precautions are taken.

47168 **Comparison of continuous moisture monitors in the range 1 to 15 ppm.** Mehrhoff, T.K. (General Electric Company, Neutron Devices Department, P. O. Box 2908, Largo, Florida 34294-2908). *Review of Scientific Instruments;* **56**: No. 10, 1930-1933(Oct 1985). Contract AC04-76DP00656.

Electrolytic, chilled mirror, and aluminum oxide dielectric hygrometers were evaluated by exposing them to known moisture levels in gaseous argon. The experiments were performed over a period of several months to determine the long-term hysteresis effects which may occur under continuous operation in the range of 1 to 15 ppm (parts per million). Air exposure effects were also examined. The results indicated hysteresis and drift problems in the case of the aluminum oxide dielectric hygrometers. The electrolytic hygrometer required a "recovery" period following exposure to high moisture levels. The chilled mirror hygrometer (with certain specified modifications) proved to be the most accurate and responsive in the 1- to 15-ppm test range.

47169 **Novel small-angle collective Thomson scattering system.** Clayton, C.E.; Darrow, C.; Joshi, C. (University of California, Los Angeles, Electrical Engineering Department, Los Angeles, California 90024). *Applied Optics;* **24**: No. 17, 2823-2826(1 Sep 1985).

A Thomson scattering opticals system is described with the following characteristics: (1) it allows scattering angles down to 1 mrad before collection optics interfere with beam dumping; (2) it gives excellent k resolution for angles of > or ≈1.5 mrad; (3) it collects light from a scattering volume which can be variably positioned without optical realignment; and (4) it is compact in size. The design, test data, and an application to ruby-laser scattering from 100-μm wavelength plasma waves are presented.

47170 **Deconvolution of concentration depth profiles from angle resolved x-ray photoelectron spectroscopy data.** Bussing, T.D.; Holloway, P.H. (Department of Materials Science and Engineering, University of Florida, Gainesville, Florida 32611). *Journal of Vacuum Science and Technology, A: Vacuum, Surfaces, and Films;* **3**: No. 5, 1973-1981(Sep 1985). Contract AS05-83ER45027.

X-ray photoelectron spectroscopy (XPS) can be made more surface sensitive by analysis of photoelectrons at small take-off angles relative to the sample surface. The intensity distribution of these angle-resolved data (ARXPS) has the potential for yielding nondestructively a depth profile of concentration in an extremely narrow surface region. Efforts to quantify ARXPS profiles have had limited success due to problems in deconvolution of the depth-concentration function from the exponential electron flux attenuation function. A new solution is shown based on inverse Laplace transforms. This approach will be compared to other approaches such as matrix inversion, iterative error reduction, and finite-layer analysis. Limitations on the quantitative accuracy of the recovered profiles are shown to be intrinsic to the numerical data reduction itself, thus compounding the effects of experimental imprecision. Examples of deconvoluted profiles from both simulated and actual experimental data sets are presented as illustrations of the potential for recovering a composition depth profile by this method.

47171 **Microcomputer-multichannel analyzer data system for foreground-background data collection and analysis.** Beard, B.C.; Dahlgren, D.; Ross P.N. Jr. (Materials and Molecular Research Division, Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720). *Journal of Vacuum Science and Technology, A: Vacuum, Surfaces, and Films;* 3: No. 5, 2041-2043(Sep 1985). Contract AC03-76SF00098.

A microcomputer-multichannel analyzer (MCA) system was assembled to obtain foreground-background performance in data collection and analysis for x-ray photoelectron spectroscopy. The MCA performs pulse counting analysis, while the microcomputer is free to evaluate previously down-loaded data or perform other computing functions. No special interfacing hardware is required beyond single digital to analog (D/A), and analog to digital (A/D) converters. Analysis and computing time is optimized with a minimum interfacing expense.

47172 **Resonance-ionization mass spectrometry for high-resolution, mass-resolved spectra of rare isotopes.** Miller, C.M.; Engleman R. Jr.; Keller, R.A. (Isotope and Nuclear Chemistry Division, Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Journal of the Optical Society of America B: Optical Physics;* 2: No. 9, 1503-1509(Sep 1985). Contract W-7405-ENG-36.

We show that resonance-ionization mass spectrometry is an excellent technique for acquiring high-resolution optical spectra of rare isotopes. To demonstrate the potential of this technique, hyperfine spectra of the $^{2}$D/sup degree//sub 3/2/ $\leftarrow$ $^{2}$D$_{3}$/sub //$_{2}$ lutetium transition at 22 125 cm$^{-1}$ are presented for $^{176}$Lu, $^{175}$Lu, $^{174}$Lu, and $^{173}$Lu. The last-named two are rare isotopes with half-lives of 3.3 and 1.4 years, respectively, whose optical spectroscopy has not previously been explored. Sensitivity is documented by the fact that the total amount of these rare isotopes in our sample was 2 x $10^{-10}$ and 3 x $10^{-11}$ g. Analysis of the spectra confirms that the spin of $^{174}$Lu is unity and yields values for the hyperfine constants and isotope shifts of these nuclei.

47173 **Monochromatic x-ray imaging with a metal multilayer camera.** van Hulsteyn, D.B.; Barbee T.W. Jr. (University of California, Los Alamos National Laboratory, P.O. Box 1663, Los Alamos, New Mexico 87545). *Applied Optics;* 24: No. 16, 2526-2535(15 Aug 1985).

A monochromatic x-ray camera consisting of a slit and two metal multilayers as the imaging elements has been built and tested. The principles by which we obtained the unity magnification and 100-μm resolution are presented. We also describe the setup for performing the throughput and resolution measurements using a Henke copper anode as the test source. Finally, several images obtained with this camera are presented and are compared with polychromatic images from a conventional x-ray pinhole camera.

47174 **Soft-x-ray microscopes.** Howells, M.; Kirz, J.; Sayre, D.; Schmahl, G. (Lawrence Berkeley Laboratory). *Physics Today;* 38: No. 8, 22-33(Aug 1985).

Major developments in sources, optics and detectors for soft x rays promise to help biologists realize the longstanding goal of high-resolution imaging of biological materials in their natural, even living, state.

47175 **Rotor for centrifugal fast analyzers.** Lee, N. E. (to The United States of America as represented by the Department of Energy). US Patent 4,509,856. 9 Apr 1985. Filed date 16 Nov 1982. vp.

PAT-APPL-442065.

The invention is an improved photometric analyzer of the rotary cuvette type, the analyzer incorporating a multicuvette rotor of novel design. The rotor (a) is leaktight, (b) permits operation in the 90° and 180° excitation modes, (c) is compatible with extensively used Centrifugal Fast Analyzers, and (d) can be used thousands of times. The rotor includes an assembly comprising a top plate, a bottom plate, and a central plate, the rim of the central plate being formed with circumferentially spaced indentations. A UV-transmitting ring is sealably affixed to the indented rim to define with the indentations an array of cuvettes. The ring serves both as a sealing means and an end window for the cuvettes.

47176 **Prefire identification for pulse power systems.** Longmire, J. L.; Thuot, M. E.; Warren, D. S. (to The United States of America as represented by the United States Department of Energy). US Patent 4,510,451. 9 Apr 1985. Filed date 23 Aug 1982. vp.

PAT-APPL-410787.

Prefires in a high-power, high-frequency, multi-stage pulse generator are detected by a system having an EMI shielded pulse timing transmitter associated with and tailored to each stage of the pulse generator. Each pulse timing transmitter upon detection of a pulse triggers a laser diode to send an optical signal through a high frequency fiber optic cable to a pulse timing receiver which converts the optical signal to an electrical pulse. The electrical pulses from all pulse timing receivers are fed through an OR circuit to start a time interval measuring device and each electrical pulse is used to stop an individual channel in the measuring device thereby recording the firing sequence of the multi-stage pulse generator.

47177 **High efficiency direct detection of ions from resonance ionization of sputtered atoms.** Gruen, D.M.; Pellin, M.J.; Young, C.E. (to Dept. of Energy). US Patent Application 6-691,825. 16 Jan 1985. 31p. Contract W-31-109-ENG-38. DE85017755 NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85017755.

A method and apparatus are provided for trace and other quantitative analysis with high efficiency of a component in a sample, with the analysis involving the removal by ion or other bombardment of a small quantity of ion and neutral atom groups from the sample, the conversion of selected neutral atom groups to photoions by laser initiated resonance ionization spectroscopy, the selective deflection of the photoions for separation from original ion group emanating from the sample, and the detection of the photoions as a measure of the quantity of the component. In some embodiments, the original ion group is accelerated prior to the RIS step for separation purposes. Noise and other interference are reduced by shielding the detector from primary and secondary ions and deflecting the photoions sufficiently to avoid the primary and secondary ions.

## 4404 Well Logging Instrumentation

47178 (EGG/10282—1057, pp 6.1-6.4) **Oriented logging tools at the Nevada test site.** Clark, S.R. (EG and G Energy Measurements Inc., San Ramon, CA). Jan 1985. NTIS, PC A19/MF A01. File Number DE85010212. (CONF-830286—).

From Symposium on remote sensing technology; Las Vegas, NV, USA (23 Feb 1983).

Large diameter boreholes drilled at the Nevada Test Site for the Department of Energy frequently exhibit an elongation in response to the regional stress field. Decentralized logging tools measure one face of the borehole by deploying a back pressure assembly. The gap between the measuring head and the rock is recorded so that proximity corrections can be made to the data. When the gap becomes too large, the data are considered unreliable. These tools invariably migrate to the long axis of the hole while logging. The long axis is the roughest and is more frequently washed out. The design of these tools, therefore, insures that the worst possible side of the borehole is being logged. A new line of geophysical logging tools has been developed at the suggestion of Lawrence Livermore National Laboratory to overcome the effect of borehole elongation. A pair of orienting arms set at 90 degrees to the measurement axis effective by turn the tool so that measurements are always recorded on the smoother, short axis of the borehole.

47179 (EGG/10282—1057, pp 7.1-7.16) **Digital processing techniques for geophysical data obtained from boreholes.** Richter, J.M. (EG and G Energy Measurements Inc., San Ramon, CA). Jan 1985. NTIS, PC A19/MF A01. File Number DE85010212. (CONF-830286—).

From Symposium on remote sensing technology; Las Vegas, NV, USA (23 Feb 1983).

A diverse set of computer programs has been developed at the Lawrence Livermore National Laboratory (LLNL) to process

geophysical data obtained from boreholes. Many different processing tasks are handled by a single, general-purpose data-manipulation program which is controlled by an instruction file. A method of denoting gaps in an otherwise continuous data trace has been devised and is recognized by every program in the system. A computer-based storage and retrieval system, which has been in operation since 1973, currently contains over 4800 data files. Most of these data were obtained from the Nevada Test site in conjuction with the nuclear test program. Each data file contains a single geophysical parameter as a function of depth. Unique filenames define the storage location of each data file. Files of interest to the user may be located by means of a search program which examines the catalog.

47180 (EGG/10282—1057, pp 9.1-9.13) **Fiber-optics data transmission and storage system for remote sensing applications.** Denton, R.H. (EG and G Energy Measurements Inc., San Ramon, CA). Jan 1985. NTIS, PC A19/MF A01. File Number DE85010212. (CONF-830286—).

From Symposium on remote sensing technology; Las Vegas, NV, USA (23 Feb 1983).

The Fiber-Optics Data Transmission and Storage System (FODTS) currently under development at SRO is a serial data acquisition unit capable of operating at 180 Mbits/s over a kilometer of optical fiber. The unit can acquire up to one megabyte of data in non-volatile memory (battery-backed RAM) and is compact enough to reside in a single CAMAC crate. Design goals were to produce a modular system with maximized microprocessor control and with enough flexibility to allow use with various data sources and data rates.

47181 (EGG/10282—1057, pp 29.1-29.10) **Measure while drilling.** Orrell, S.A. (EG and G Energy Measurements Inc., Kirtland, OH). Jan 1985. NTIS, PC A19/MF A01. File Number DE85010212. (CONF-830286—).

From Symposium on remote sensing technology; Las Vegas, NV, USA (23 Feb 1983).

An electric current loop method of telemetry is investigated in a practical situation. In particular, the feasibility of this method, using the drill string of a large bore drilling rig during normal operations for telemetry from a drill bit to the surface, Measure While Drilling (MWD), is reported.

# 45 EXPLOSIONS AND EXPLOSIVES

## 4501 Chemical

47182 (LA-UR—85-2964) **Coherent and spontaneous Raman spectroscopy in shocked and unshocked liquids.** Schmidt, S.C.; Moore, D.S.; Schiferl, D.; Chatelet, M.; Turner, T.P.; Shaner, J.W.; Shampine, D.L.; Holt, W.T. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 46p. (CONF-8508119—1). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85017543.

From NATO advanced study institute: advances in chemical reaction dynamics; Iraklion, Crete (25 Aug 1985).

Coherent and non-coherent Raman spectroscopy is being used to study the structure and energy transfer in molecular liquids at high pressures. Stimulated Raman scattering, coherent anti-Stokes Raman scattering, and Raman induced Kerr effect scattering measurements have been performed in liquid benzene and liquid nitromethane shocked to pressures up to 11 GPa. Frequency shifts were observed for the 992 $cm^{-1}$ ring stretching mode of benzene and the 920 $cm^{-1}$ CN stretching mode of nitromethane. Results of these dynamic experiments are compared to spontaneous Raman scattering measurements made in a high temperature diamond anvil cell. Also, a picosecond infrared pump/spontaneous anti-Strokes Raman probe experiment is being used to measure CH stretch vibrational relaxation times in liquid halogenated methanes statically compressed to a few tenths GPa. 87 refs., 17 figs.

47183 (MLM—3288(OP)) **High strength glass-ceramic to metal seals.** Haws, L.D.; Kramer, D.P.; Moddeman, W.E.; Wooten, G.W. (Monsanto Research Corp., Miamisburg, OH (USA). Mound). 1985. Contract AC04-76DP00053. 41p. (CONF-850836—6). NTIS, PC A03/MF A01; GPO Dep. File Number DE85017422.

From American Institute of Chemical Engineers national meeting; Seattle, WA, USA (25 Aug 1985).

In many applications, ceramics are joined to other materials, especially metals. In such cases, interfacial strength is as important as the strength of each constituent material. Examples are presented for tailoring materials and processes to optimize the glass-ceramic to metal seal. Means for detecting defects, non-destructively, are also identified. 7 refs., 15 figs., 3 tabs.

47184 (MLM—3291(OP)) **Mechanism of failure of two pyrotechnic components.** Munger, A.C.; Woods, C.M. (Monsanto Research Corp., Miamisburg, OH (USA). Mound). 1985. Contract AC04-76DP00053. 21p. (CONF-850742—2). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85017421.

From International Pyrotechnics Society symposium; Karlsruhe, F.R. Germany (3 Jul 1985).

An investigation of two unrelated pyrotechnic test device misfires revealed an ignition phenomenon that helps to explain the well-known necessity of maintaining good integrity between bridgewire and powder in hot-wire devices that use insensitive pyrotechnic powders. The factor common to both devices was the TiH/sub 1.65/:$KC10_4$ in a 33:67 weight percent ratio. This material is being used because of its high static insensitivity, a characteristic that makes good bridgewire contact mandatory for reliable ignition. Extensive work with a scanning electron microscope revealed that not only does the bridgewire require entrapment, but the initiation reaction gases must be contained within the immediate vicinity of the bridgewire or the initiation will not be sustained. Evidence is presented to document the phenomenon that caused the misfire of both components that were investigated. 9 refs., 17 figs.

47185 (MLM-MU—85-68-0002) **Mound powder loader, Mod 1.** Gress, A.V. Jr. (Monsanto Research Corp., Miamisburg, OH (USA). Mound). 21 Aug 1985. Contract AC04-76DP00053. 28p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85017384.

At the investigation of Sandia Albuquerque, a semiautomatic powder loader was designed and fabricated for pyrotechnics devices. The basic functions of the system were to load a precise, measured amount of powder into a charge holder and to compact the mixture to a specified density. This report documents the history, rationale, design, and performance of the Mod 1 loader.

47186 (SAND—85-0788C) **Dilatancy in rocks during stress wave unloading.** Butcher, B.M.; Costin, L.S. (Sandia National Labs., Albuquerque, NM (USA)). 1985. Contract AC04-76DP00789. 15p. (CONF-850953—3). NTIS (US Sales Only), PC A02/MF A01; GPO Dep. File Number DE85017371.

From 3. symposium on containment of underground nuclear explosions; Idaho Falls, ID, USA (10 Sep 1985).

The dilatancy of rocks and soils during stress wave propagation and whether or not it should be included in wave propagation analysis is often a topic for discussion. Most underground explosions result in mean stresses that are high enough to inhibit extensive dilation during loading of rock. In contrast, dilatancy stress reduction may occur as the rock unloads to the residual stress state. This effect has been considered in several recent explosion containment studies because it can modify predictions of residual stress states and the final radii of the explosion cavities. This paper explores the conditions for which dilation during unloading of volcanic rock is expected to introduce nonlinearity in the unloading stress-strain path. Stress wave load path simulations with various material models are used to illustrate the magnitudes of the expected changes. An advanced material model for brittle rock deformation by microcrack growth, recently developed by Costin, is included in this comparison. This model shows that damage to the rock is greater during the lateral unloading portion of the stress cycle. In addition, reference is made to recent quasistatic experi-

ment results, which illustrate different observed modes of deformation during unloading and how they influence strain recovery. 12 refs., 5 figs.

47187 **(SRD-R—173) GASEX2: a two dimensional hydrodynamic code for use in gas cloud explosion calculations.** Martin, D. (UKAEA Safety and Reliability Directorate, Culcheth). Feb 1983. 36p. United Kingdom Atomic Energy Authority, Culcheth, Warrington, England. File Number TI85901935.

This report briefly describes the methods used by the program GASEX2 and describes in more detail the input constants for running the program. The form of output obtained from the program is described. A brief outline of the type of calculations which are possible for gas cloud explosions, is given. 5 refs.

47188 **Semiconductor bridge (SCB) igniter.** Bickes, R.W. Jr.; Schwarz, A.C. (to Dept. of Energy). US Patent Application 6-702,716. 19 Feb 1985. 40p. Contract AC04-76DP00789. DE85017806 NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85017806.

In an explosive device comprising an explosive material which can be made to explode upon activation by activation means in contact therewith; electrical activation means adaptable for activating said explosive material such that it explodes; and electrical circuitry in operational association with said activation means; there is an improvement wherein said activation means is an electrical material which, at an elevated temperature, has a negative temperature coefficient of electrical resistivity and which has a shape and size and an area of contact with said explosive material sufficient that it has an electrical resistance which will match the resistance requirements of said associated electrical circuitry when said electrical material is operationally associated with said circuitry. This electrical material is polycrystalline or is crystalline and (a) is mounted on a lattice matched substrate or (b) is partially covered with an intimately contacting metallization area which defines its area of contact with the explosive material. 3 figs., 5 tabs.

47189 **Extrusion cast explosive.** Scribner, K.J. (to Dept. of Energy). US Patent Application 6-696,276. 29 Jan 1985. 20p. Contract W-7405-ENG-48. DE85017785 NTIS, PC A02/MF A01; GPO Dep. File Number DE85017785.

Improved, multiphase, high performance, high energy, extrusion cast explosive compositions, comprising, a crystalline explosive material; an energetic liquid plasticizer; a urethane prepolymer, comprising a blend of polyvinyl formal, and polycaprolactone; a polyfunctional isocyanate; and a catalyst are disclosed. These new explosive compositions exhibit higher explosive content, a smooth detonation front, excellent stability over long periods of storage, and lower sensitivity to mechanical stimulants. 1 fig.

47190 **Miniature plasma accelerating detonator and method of detonating insensitive materials.** Bickes, R.W. Jr.; Kopczewski, M.R.; Schwarz, A.C. (to Dept. of Energy). US Patent Application 6-688,672. 4 Jan 1985. 19p. Contract AC04-76DP00789. DE85017747 NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85017747.

The invention is a detonator for use with high explosives. The detonator comprises a pair of parallel rail electrodes connected to a power supply. By shorting the electrodes at one end, a plasma is generated and accelerated toward the other end to impact against explosives. A projectile can be arranged between the rails to be accelerated by the plasma. An alternative arrangement is to a coaxial electrode construction. The invention also relates to a method of detonating explosives. 3 figs.

47191 **Spot test for 1,3,5-triamino-2,4,6-trinitrobenzene, TATB.** Harris, B.W. (to Dept. of Energy). US Patent Application 6-676,149. 29 Nov 1984. 8p. Contract W-7405-ENG-36. DE85017725 NTIS, PC A02/MF A01; GPO Dep. File Number DE85017725.

A simple, sensitive and specific spot test for 1,3,5-triamino-2,4,6-trinitrobenzene, TATB, is described. Upon the application of the composition of matter of the subject invention to samples containing in excess of 0.1 mg of this explosive, a bright orange color results. Interfering species such as TNT and Tetryl can be removed by first treating the sample with a solvent which does not dissolve the TATB, but readily dissolves these interfering explosives.

47192 **Study of the thermal decomposition of confined triaminotrinitrobenzene. The gaseous products and kinetics of evolution.** Catalano, E.; Rolon, C.E. (Lawrence Livermore National Lab., CA). *Thermochimica Acta;* 61: 37-51(1983). Contract W-7405-ENG-48.

The thermal decomposition of confined triaminotrinitrobenzene (TATB) has been studied by observation of infrared matrix isolation spectra, mass spectra, and pressure-time response of the product gases. Solid state products were examined by infrared spectroscopy and scanning electron microscopy. Four distinct reaction regimes were found using the gaseous product data; a slow endothermic stage followed by two slow exothermic stages, and culminating in a deflagration (explosive) reaction above the critical temperature.

## 4502 Nuclear

47193 **(AD-A—154669/6/XAB) Nuclear thermal transmittance in the atmosphere using LOWTRAN-6 computer code. Master's thesis.** Leonard, J.M. (Air Force Inst. of Tech., Wright-Patterson AFB, OH (USA). School of Engineering). Mar 1985. 66p. NTIS, PC A04/MF A01.

The purpose of this thesis is to provide the nuclear weapons-effect analyst with accurate transmittance data for burst/target geometries and atmospheric conditions in which thermal radiation effects are of significance, yet without having to run a complex computer code for each specific case being investigated. Transmittance values for several realistic sets of atmospheric conditions were obtained using the 1962 U.S. Standard Atmospheric Model and the LOWTRAN Rural, Urban, Maritime, Tropospheric, and Stratospheric aerosol models. Boundary-layer (0 - 2 km) transmittance calculations, using the Rural, Urban, and Maritime aerosols, were accomplished for sea-level visibilities of 5, 10, 15, and 23 km. A computer program was developed to weight the LOWTRAN-6 output transmittances according to a 6000 K Planckian distribution, simulating a nuclear weapon source. The geometry chosen is for the region where thermal radiation has a significant damage potential to Air Force systems; altitudes from sea-level to 20 kilometers, and ground ranges from 0 - 25 kilometers from weapon ground-zero. The results are displayed in a graphical format, providing the user with accurate nuclear thermal atmospheric transmittance data.

47194 **(AD-A—154861/9/XAB) Nuclear winter: implications for US and Soviet nuclear strategy.** Romero, P.J. (RAND Corp., Santa Monica, CA (USA)). Dec 1984. 27p. (RAND-P—7009-RGI). NTIS, PC A03/MF A01.

In November 1983 Dr. Carl Sagan and his colleagues reported to press on the results of their study of the atmospheric consequences of nuclear war. The TTAPS study found that for a wide range of possible U.S. -Soviet nuclear exchanges, including relatively small ones, the fires from nuclear detonations would inject into the stratosphere quantities of dust and soot that would obscure sunlight for months. Under the cloud, which would spread over most of the Northern Hemisphere, temperatures might drop scores of degrees, well below the freezing point of water; thus, nuclear winter. The TTAPS team's findings suggested that the consequences of a nuclear war might be even more gruesome than previously supposed, and the long-term climatic and biological results might be nearly as severe for a war of 100 megatons as for 5,000. From the point of view of informing policymakers and the public concerning the consequences of wars involving nuclear weapons, the politicization of the nuclear winter issue is unfortunate. We can hope that in the next few years the criticism and defense of the initial TTAPS work will give rise to significant additional analyses, to illuminate the question. Realistically, further study will probably include both confirmations and contradictions of the original findings, without necessarily resolving the issue. Sadly, the surrounding political atmosphere may obstruct sober consideration of the policy implications of the possibility of nuclear winter.

47195 **(UCRL—93194) Militarily significant nuclear explosive yields.** Kidder, R.E. (Lawrence Livermore National Lab., CA (USA)). Aug 1985. Contract W-7405-ENG-48. 10p. (CONF-850779—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85017271.

From Cavity decoupling workshop; Pajaro Dunes, CA, USA (29 Jul 1985).

A graph of the distribution of US nuclear tests versus yield during the five year period 1980 through 1984 is presented. It is claimed that this distribution provides a measure of the military significance of nuclear tests versus yield, given the constraints on nuclear testing then in effect. It is found that the military significance of tests in the neighborhood of 10 kilotons and 150 kilotons is high by this measure; and that the significance of nuclear tests with yields less than a kiloton, relative to that of tests at higher yield, is low. It is noted that the military significance of nuclear tests versus yield will depend upon the constraints on testing that may exist. If all tests above one kiloton were forbidden, for example, there would doubtless be a marked increase in both interest and significance of sub-kiloton tests. A facility in which such tests could be safely contained has been under consideration for some time.

### 4503 Explosion Detection

47196 **(AD-A—154710/8/XAB) Robust detection and classification of regional seismic signals using a two mode/two stage Cascaded Adaptive ARMA (CAARMA) model. Final report, 15 July 1983-14 July 1984.** Schnitta-Israel, B. (KLD Associates, Inc., Huntington, NY (USA)). Mar 1985. 169p. NTIS, PC A08/MF A01.

The objective of this contract was to tailor TRAPS (Transient Acoustic Processing System) to the seismic event monitoring application thus providing a powerful tool for the nuclear monitoring problem. TRAPS is a three stage process. Stage One is a hybrid adaptive filter designed to perform noise elimination on each receiver component. This is beamformed and input into Stage Two which performs signal enhancement. Information resulting from Stage One/Two is used in Stage Three to calculate the location and classification of the detected event. While the original TRAPS succeeded in doubling the range of detection, it did so with a standard beamformer. Task 1 was to ascertain if an adaptive beamformer (AB) incorporated into TRAPS would produce any gains. It was determined that TRAPS Stage One followed by a standard beamformer was superior to an AB, yet an AB strategically placed between TRAPS Stage One and Stage Two provided some processing gain.

## 50 ENVIRONMENTAL SCIENCES, ATMOSPHERIC

### 5001 Basic Studies

*REFER ALSO TO CITATION(S) 47497*

47197 **(CONF-8406175—2) Successive over-relaxation solutions of finite element approximation of advection-diffusion equations.** Yeh, G.T. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 6p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016378.

From International Association of Science and Technology for Development international conference on applied simulation and modeling; San Francisco, CA, USA (4 Jun 1984).

Both the successive over-relaxation (SOR) iteration and in-core direct band-matrix solution (DBS) algorithm are used to solve matrix equations resulting from four finite element approximations of advection-diffusion equations: (1) nodal quadrature of upstream weighting (NQUW), (2) nodal quadrature of Galerkin weighting (NQGW); (3) Gaussian quadrature of upstream weighting (GQUW), and (4) Gaussian quadrature of Galerkin weighting (GQGW). Three simple examples are employed to compare computational efficiency and numerical performance of these four finite element approximations in terms of (1) their susceptibility to the SOR iteration and hence CPU memory requirement and CPU time need and (2) their numerical accuracy. Numerical experiments indicate that for real-world applications, the SOR iteration on the NQUW approximation provides perhaps the only choice among the four schemes at the expense of slight numerical accuracy.

47198 **(EUR—9503-EN) Development of a prototype mesoscale computer model incorporating treatment of topography.** Apsimon, H.; Kitson, K.; Fawcett, M.; Goddard, A.J.H. (Commission of the European Communities, Luxembourg. Directorate-General for Information, Market and Innovation). 1984. 258p. Commission of the European Communities, Luxembourg. Office of Official Publications of the European Communities.

Complex modelling such as MATHEW/ADPIC or WAFT/TOMCATS produce a real advantage. The systems are expensive to operate and require a network of stations measuring winds and some vertical wind soundings. Such a large investment raises large expectations. However, it has been shown that there are a lot of difficulties with such techniques which affect accuracy and uncertainty in the prediction.

47199 **(FOA-A—20032-D8) Aerosol clouds and their transmission properties - research, models and applications.** Wahlborn, S. (Foersvarets Forskningsanstalt, Stockholm (Sweden)). May 1983. 48p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85752511.

The starting point for this report is the physical fact that all aerosols attenuate radiation passing through them. Hence, models for the understanding and description of related phenomena have wide use in many areas, such as environmental research. The aim of the report is twofold. On one hand, the aim is to give an account of theories and models for the study of optical transmission pattern in aerosol cloud, on the basis of the attenuation characteristics for aerosols and the dispersion properties of clouds. Methods of computation and measurement are described. On the other hand, the aim is to furnish a -state of the art- account of the research on aerosols and aerosol clouds with special regard to its applications and related systems approach. In particular, military applications - the use of protective aerosols - are reviewed. This report has been written to serve specialists (transmission models and measurements) as well as non-specialists (basic descriptions and overviews). It is noted, as one conclusion, that satisfactory competence is available in Sweden to acquire and analyze basic data for various properties of aerosol clouds. However, in this country, there is little coordination of the resources for applications and problem oriented work.

47200 **(KFK—3928) Test report on the monostatic Doppler SODAR B.** Holleuffer-Kypke, R. von; Huebschmann, W.; Thomas, P. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Meteorologie und Klimaforschung). May 1985. 85p. (In German). NTIS (US Sales Only), PC A05/MF A01. File Number DE85752335.

SODAR B has been routinely operated on the meteorological meadow of the KfK, which is located close to the 200 m high meteorological tower and is surrounded by forest. The SODAR B comprises three antennas mounted on a common carriage. The antennas transmit alternatingly in a 3 s sequence an acoustic pulse of 1585 Hz and 1615 Hz (mixed) upwards into the atmosphere. During the test period the SODAR B has proven a high availability. Only the foam cover inside the antennas had to be replaced by a weather resistent one. The following data have been measured and recorded, a. o.: the 10 min averages of the wind direction and velocity and the standard deviation of the vertical wind velocity, each from 60 m up to 420 m height in steps of 20 m. These data have been compared with the data measured at the meteorological tower at whichever heights the relevant instruments are mounted at the tower. At heights of 60 m and more the correlation coefficient of the wind direction amounts to more than 0.92, the one of the wind velocity at heights of 80 m and more to more than 0.80 and the one of the standard deviation at 100 m and during certain time periods to more than 0.7.

**47201 (KFK—3929) Test report on the monostatic Doppler SODAR R.** Holleuffer-Kypke, R. von; Huebschmann, W.; Thomas, P. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Meteorologie und Klimaforschung). May 1985. 80p. (In German). NTIS (US Sales Only), PC A05/MF A01. File Number DE85752337.

SODAR R has been routinely operated for 12 months on the meteorological meadow of the KfK, which is located close to the 200 m high meteorological tower and is surrounded by forest, and afterwards for 5 weeks at a neighbouring place, which is less influenced by the forest. The SODAR R comprises three antennas mounted each on a carriage. The antennas transmit alternatingly in a 3 s sequence an accoustic pulse of 1675 Hz upwards into the atmosphere. During the test period the SODAR R has proven a high availability even under winter conditions. Only a few repairs have been necessary. The following data have been measured and recorded, a. o.: the 10 min averages of the wind direction and velocity and the standard deviation of the vertical wind velocity, each from 40 m up to 420 m height in steps of 20 m. These data have been compared with the data measured at the meteorological tower at whichever height the relevant instruments are mounted at the tower. At heights of 100 m and more the correlation coefficient of the wind direction amounts to more than 0.95, the one of the wind velocity to more than 0.90 and the one of the standard deviation during certain time periods to more than 0.7.

**47202 (NP—5770369) Application of a turbulence closure scheme to the parameterisation of vertical heat, momentum and moisture diffusion in the ECMWF forecasting model.** Duemenil, L. (Koeln Univ. (Germany, F.R.). Inst. fuer Geophysik und Meteorologie). 1984. 105p. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE85770369.

The scheme contains an additional prognostic equation for turbulent kinetic energy and computes diffusion coefficients that are not only Richardson number dependent as in the operational model, but depend on turbulent kinetic energy as well. Due to the simplification process, however, diffusion coefficients may become infinite. These values have to be limited and turbulent kinetic energy restricted to positive values in order to provide stable model integrations. For technical reasons, the model was first tested in a simpler form without taking advection of turbulent kinetic energy into account. In this version, the turbulence closure scheme performs very similarly to the operational one with slight improvements in special cases. Although the scheme partly corrects the systematically erroneous energy budget of the model by an intensified hydrological cycle, the quality of 10-day-forecasts is only marginally improved. Sensitivity to the inclusion of the advection of turbulent kinetic energy on the level and geographical distribution of turbulence, suggests that these terms ought to be retained, even though no improvement of the forecast can be gained.

**47203 (UCID—20513) Forward and backward trajectories using GRANTOUR: a preliminary study for Arctic trajectories.** Tan, A.; Walton, J.J.; MacCracken, M.C. (Lawrence Livermore National Lab., CA (USA)). Aug 1985. Contract W-7405-ENG-48. 15p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85017875.

Traditional air trajectory models utilize various constant-pressure trajectory methods, known as "isobaric" trajectory models, although it has been recognized that "isentropic" trajectories would be more accurate when large temperature gradients are encountered. This study reports calculations of forward and backward trajectories using the LLNL GRANTOUR transport model. This model accounts for the vertical transport disregarded in the isobaric methods and accurately transports smoke with the three-dimensional wind field. Preliminary findings indicate that GRANTOUR trajectories, which actually follow the true parcel trajectory, are generally consistent with those obtained by the isentropic method, at least in the Arctic.

## 5002 Chemicals Monitoring And Transport

*REFER ALSO TO CITATION(S) 46022, 46080, 46082, 46083, 46399, 46669, 46713, 46905, 46981, 47187, 47237, 47246, 47428*

**47204 (BNL—36806) Discussion of sabotage vulnerabilities: consequences of airborne releases.** Lu, M.S.; Epel, L.G. (Brookhaven National Lab., Upton, NY (USA)). 1985. Contract AC02-76CH00016. 6p. (CONF-850765—36). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85017548.

From 26. annual meeting of the Institute of Nuclear Materials Management; Albuquerque, NM, USA (21 Jul 1985).

A simplified mathematical model has been developed to provide conservative estimates of radioactive and/or chemical dispersal consequences. The model is useful in assessing physical security protection needs and determining classification levels for information on DOE facilities. Sabotage scenarios for dispersals were developed based on public information, such as safety analysis reports and environmental impact statements for facilities of interest. The dispersal mechanisms considered included criticality incidents, explosive methods, pyrotechnics, lofting, etc. The technical knowledge required by a malevolent group intent upon causing dispersal includes the attack objective information, (target, source-consequences correlation and propagation characteristics) as well attack capability information (physical security, disperal know-how and engineered safety and protection features). Physical protection measures, which could protect materials via deterrence, detection, delay and apprehension, were suggested, along with classification techniques which could protect against dispersal by denying access to information critical to the success of sabotage. 9 refs., 6 figs.

**47205 (CONF-850612—9) Characterization and mitigation of organic vapors.** Hawthorne, A.R.; Matthews, T.G.; Gammage, R.B. (Oak Ridge National Lab., TN (USA)). 1985. Contract AC05-84OR21400. 11p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016410.

From Air Pollution Control Association annual meeting and exhibition; Detroit, MI, USA (16 Jun 1985).

The more established methodology of pumped vapor collection on solid sorbents followed by gas chromatography or gas chromatography/mass spectrometry for characterizing emissions and resulting indoor concentrations of organic pollutants is reviewed. In addition, less frequently used alternative approaches that emphasize low-cost, rapid response methods of characterizing indoor organic pollutants are presented. Examples include a portable photoionization gas chromatograph and a nondestructive formaldehyde surface emission monitor. Highlights of an experiment in an unoccupied research house to evaluate the effectiveness of permeation barriers in reducing the formaldehyde emission rate from particleboard underlayment and the corresponding room concentrations are discussed.

**47206 (CONF-8505194—1) Measuring environmental emissions from tobacco combustion: sidestream cigarette smoke review.** Guerin, M.R.; Higgins, C.E.; Jenkins, R.A. (Oak Ridge National Lab., TN (USA)). 1985. Contract AC05-84OR21400. 20p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85013222.

From Conference on characterization of contaminant emissions from indoor sources; Triangle Park, NC, USA (13 May 1985).

The tobacco-derived environmental emission of most common concern is the smoke issuing from cigarettes between puffs. A review of smoke formation mechanisms, sampling methods, and selected emission factors suggests that sidestream deliveries are actually much less variable than is commonly thought. Examples of devices used to generate and collect sidestream smoke for analysis are described. Emissions computed as is common practice from sidestream/mainstream ratios are compared to those determined directly. 36 refs., 3 figs., 2 tabs.

**47207 (CONF-8505195—1) Models for estimating organic emissions from building materials.** Hawthorne, A.R.; Matthews, T.G. (Oak Ridge National Lab., TN (USA)). 9 May 1985. Contract AC05-84OR21400. 21p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85013233.

From EPA conference on characterization of sources of indoor air contaminants; Chapel Hill, SC, USA (12 May 1985).

One important source of chronic exposure to low levels of organic compounds in the indoor environment is emissions from building materials. Because removal of offending products may be costly or otherwise impractical, it is important that the emissions of organic pollutants be understood prior to incorporation of these materials into buildings. Once the organic pollutants of concern are identified, based on potential health effects and emission potential from building material, it is necessary that an emission model be developed to predict the behavior of emission rates under various indoor conditions. Requirements of models for estimating organic emissions from building materials into the indoor environment are presented. Important factors that must be considered include the products' characteristic source strengths at standard test conditions, impact of variations in temperature and humidity, concentrations of the modeled organic pollutants in indoor environments, and product ages. Ideally, emission models should have physical/chemical bases so that the important physical factors can be identified and their relative importance quantified. The most studied of the volatile organic compounds from building materials, formaldehyde, is used as an example to illustrate the development of a model for organic emissions. 18 refs., 1 fig., 1 tab.

47208 **(DFVLR-FB—85-25) Airborne measurements of the border-crossing air pollution in the area between Weiden and Hof/Bavaria.** Paffrath, D. (Deutsche Forschungs- und Versuchsanstalt fuer Luft- und Raumfahrt e.V., Koeln (Germany, F.R.)). 1985. 80p. (In German). NTIS (US Sales Only), PC A05/MF A01. File Number DE85752701.

The air pollution burden is particularly high in the border-near area between Weiden and Hof due to exhaust gases produced by Czechoslovakian sources. Mass fluxes of $SO_2$, NOsub(x) and NO were determined here by airborne measurements of horizontal and vertical distributions of concentrations and of wind profile measurements. The results show that the mass fluxes vary to a large extent depending on the fluctuating emission rate, on the weather situation and on the season of the year.

47209 **(EUR—9597-EN) Corrosion studies on collector materials.** Bogaerts, W.; Haute, A. van; Weisgerber, P. (Commission of the European Communities, Luxembourg. Directorate-General for Information, Market and Innovation). 1985. 54p. Commission of the European Communities, Luxembourg. Office of Official Publications of the European Communities.

The present paper contains a synopsis of the results of two previously reported literature studies on 'Absorber Surfaces and Durability of Solar Heat Collectors' and on 'Atmospheric Corrosion and Degradation of Construction Materials for Solar Collectors'. It also presents the results of a number of long- and short-term atmospheric corrosion tests on solar absorber plates in various $SO_2$-polluted atmospheres. Results are quantitatively compared for the different collector types and environments. Correlations have been determined with short-term qualification tests at high $SO_2$ concentrations.

47210 **(NP—5902041) Assessment of acid precipitation monitoring sites north of Houston. Final report.** Liljestrand, H.M. (Texas Univ., Austin (USA). Center for Energy Studies). 1985. 106p. NTIS, PC A06. File Number DE85902041.

This paper complies and evaluates pH data for Texas from 1978 to 1983. By assuming the measured pH must agree within the measured net strong acidity (C/sub A/-C/sub B/) by anion and cation analysis, a test of the quality of the pH measurements is provided. This is a more stringent test than a balance of measured cation and anion charge concentrations, and careful pH measurements and ion analyses must be made for >90% of the pH values to agree within the statistical uncertainties of the analytical methods. 11 figs., 8 tabs.

47211 **Removal of sulfur and nitrogen containing pollutants from discharge gases.** Joubert, J.I. (to Dept. of Energy). US Patent Application 6-699,889. 8 Feb 1985. 15p. DE85017799 NTIS, PC A02/MF A01; GPO Dep. File Number DE85017799.

Oxides of sulfur and of nitrogen are removed from waste gases by reaction with an unsupported copper oxide powder to form copper sulfate. The resulting copper sulfate is dissolved in water to effect separation from insoluble mineral ash and dried to form solid copper sulfate pentahydrate. This solid sulfate is thermally decomposed to finely divided copper oxide powder with high specific surface area. The copper oxide powder is recycled into contact with the waste gases requiring cleanup. A reducing gas can be introduced to convert the oxide of nitrogen pollutants to nitrogen.

47212 **Recirculating electric air filter.** Bergman, W. (to Dept. of Energy). US Patent Application 6-690,022. 9 Jan 1985. 12p. Contract W-7405-ENG-48. DE85017751 NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85017751.

An electric air filter cartridge has a cylindrical inner high voltage electrode, a layer of filter material, and an outer ground electrode formed of a plurality of segments moveably connected together. The outer electrode can be easily opened to remove or insert filter material. Air flows through the two electrodes and the filter material and is exhausted from the center of the inner electrode.

47213 **Disk filter.** Bergman, W. (to Dept. of Energy). US Patent Application 6-690,023. 9 Jan 1985. 14p. Contract W-7405-ENG-48. DE85017752 NTIS, PC A02/MF A01; GPO Dep. File Number DE85017752.

An electric disk filter provides a high efficiency at high temperature. A hollow outer filter of fibrous stainless steel forms the ground electrode. A refractory filter material is placed between the outer electrode and the inner electrically isolated high voltage electrode. Air flows through the outer filter surfaces through the electrified refractory filter media and between the high voltage electrodes and is removed from a space in the high voltage electrode.

47214 **Power plant influences on bulk precipitation, throughfall, and stemflow nutrient inputs.** Kelly, J.M. (Oak Ridge National Lab., TN). *Journal of Environmental Quality;* 13: No. 3, 405-409(Jul-Sep 1984).

Inputs of $SO_4^{2-}$, total N, $PO_4^{3-}$, K, Ca, and Mg via bulk precipitation, throughfall, and stemflow have been investigated over a 3-year period at two forest study sites on the Cumberland Plateau of Tennessee. The Cross Creek Watershed located 19 km from the Widows Creek coal-fired power plant was used to represent inputs to a forest site in the immediate vicinity of a large emissions source. The Camp Branch Watershed having similar forest cover and soil types, but located in an area 99 and 76 km from the nearest major point sources, was used to represent inputs as a function of regional conditions. Location exhibited its greatest influence on stemflow inputs, with only $PO_4^{3-}$ and K failing to exhibit a statistically significant ($P = 0.05$) increase in stemflow input at Cross Creek relative to Camp Branch. Although throughfall $SO_4^{2-}$, K, Ca, and Mg input values were higher at Cross Creek, they were not significantly higher than the Camp Branch values. Nitrogen and phosphate throughfall input values were lower at Cross Creek than Camp Branch, but again lacked statistical significance. Nitrogen and phosphate in bulk precipitation were significantly elevated at Cross Creek while other elements and compounds did not respond to location. Based on this evaluation most atmospheric contributions to bulk precipitation, throughfall, and stemflow elemental inputs appear to be of regional rather than local origin. 18 references, 3 figures, 2 tables.

47215 **Effects of acidic and neutral sulfate salt solutions on forest floor arthropods.** Craft, C.B.; Webb, J.W. (Oak Ridge National Lab., TN). *Journal of Environmental Quality;* 13: No. 3, 436-440(Jul-Sep 1984). Contract W-7405-ENG-26.

Acidic and neutral $SO_4^{2-}$ solutions were applied to a mixed oak (Quercus spp.) forest floor on Walker Branch Watershed in eastern Tennessee to study effects of increased acid deposition on decomposer arthropods and arthropod regulation of P cycling. Over a 14-month period, the number of forest floor macroarthropods averaged 19% lower in the high $SO_4^{2-}$ salt treatment compared with the control. Macroarthropod fungivores also were adversely affected by the high $SO_4^{2-}$ salt treatment and by the high

and low $KHSO_4$ treatments. Microarthropod numbers increased significantly in response to low $K_2SO_4$ additions and to high and low $KHSO_4$ treatments. Microarthropod fungivores, predators, and detritivores responded similarly. Comparison of microarthropod densities and soil $K^+$ concentrations suggested that the response resulted from a direct fertilizer effect of $K^+$ on arthropods or indirectly from an effect on microorganisms. Although increased inputs of $H^+$ appear to have little effect on decomposer arthropods, effects of nonacidic $SO_4^{2-}$ warrant further study. 39 references, 3 figures, 2 tables.

47216 **Non-ammonium reduced nitrogen species in atmospheric aerosol particles.** Dod, R.L.; Gundel, L.A.; Benner, W.H.; Novakov, T. (Lawrence Berkeley Lab., CA). *Science of the Total Environment;* **36**: 277-282(1984). Contract AC03-76SF00098.

The traditional belief that ambient aerosol particles contain nitrogen predominantly in the form of inorganic ionic species such as $NH_4^+$ and $NO_3^-$ was challenged about 10 years ago by results from x-ray photoelectron spectroscopic analysis (ESCA) of California aerosol particles. A significant fraction ($\sim$ 50%) of the reduced nitrogen was observed to have an oxidation state more reduce than ammonium, characteristic of organic nitrogen species. We have used a recently developed thermal evolved gas analysis method (NO/sub x/) in conjunction with ESCA to confirm the existence of these species in aerosol particles collected in both the United States and Europe. The agreement of EGA and ESCA analyses indicates that these species are found not only on the surface but also throughout the particles.

47217 **Dissociation of weak acids during Gran plot free acidity titrations.** Lindberg, S.E.; Coe, J.M.; Hoffman, W.A. (Oak Ridge National Lab., TN). *Tellus;* **36B**: No. 3, 186-191(1984). Contract W-7405-ENG-26.

A comparison of weak and free acid concentrations measured by base titration and hydrogen ion activities determined by direct pH measurement is described for several data sets for rain collected above and below a forest canopy in the eastern United States. These data illustrate the influence of weak acid dissociation during titration and the possible effect of activity coefficients on calculated free acid concentrations. 13 references, 2 figures, 1 table.

47218 **Performance of a screen-type diffusion battery.** Cheng, Y.S.; Yeh, H.C. (Lovelace Inhalation Toxicology Research Institute, Albuquerque, NM). pp 1077-1094 of Aerosols in the mining and industrial work environments. Volume 3. Instrumentation. Marple, V.A.; Liu, B.Y.H. (eds.). Ann Arbor, MI; Ann Arbor Science Publishers (1983). Contract AC04-76EV01013.

A theoretical analysis based on filtration theory of penetration efficiency of aerosols through screen-type diffusion batteries was developed and tested by comparison with experimental calibrations. Monodisperse aerosols ranging from 0.01 to 0.22 $\mu$m were used in the experiments. Four stainless steel screens (145, 200, 400 and 635 mesh screen) and a metallized polyester screen were used as the diffusion cell material in the battery. Good agreement was found between theoretical predictions and the experimental data from all four stainless steel screens. The results provided a basis for understanding the performance of screen-type diffusion batteries and for designing new diffusion batteries. The equation derived was incorporated into a computer program to facilitate data analysis of samples collected by the instrument under different operational conditions. Comparisons of aerosol size measurements by the diffusion battery and other instruments were made using laboratory test aerosols. The results indicated that both the diffusion battery and the electrical aerosol analyzer (EAA) give accurate mean diameters but have larger standard deviations ($1.3 < \sigma g < 1.6$) for monodisperse aerosols ($\sigma g \sim 1.10$) than those determined by the electrical classifer and electron microscopy. A field sampling aerosol instrument assembly, consisting of a diffusion battery and an EAA, and its performance are described.

47219 **Measurement of biological activity of ambient air mixtures using a mobile laboratory for in situ exposures: preliminary results from the Tradescantia plant test system.** Schairer, L.A.; Van't Hof, J.; Hayes, C.G.; Burton, R.M.; de Serres, F.J. (Brookhaven National Lab., Upton, NY). pp 421-440 of Application of short-term bioassays in the fractionation of complex environmental mixtures (1979). Waters, M.D.; Nesnow, S.; Huisingh, J.L.; Sandhu, S.S.; Claxton, L. (eds.). New York, NY; Plenum Publishing Corporation (1979).

The body of evidence is growing for a meaningful extrapolation from cytological and genetic effects in microorganisms, cell cultures, plants, insects, and mammals to health hazards in man. The high correlation between mutagenicity and carcinogenicity supports the use of visible genetic markers in test organisms as monitors for carcinogens. The observation of similar chromosome aberrations in both gametic and somatic tissues gives cytological evidence for the effectiveness of somatic mutation markers as an assay for chemical mutagenicity and hence health hazard potential. The Tradescantia stamen hair system encompasses the cytogenetic and somatic potential to make the system a useful tool for mutagenicity monitoring of ambient air pollution mixtures or isolated fractions. This plant is uniquely adapted to field exposures, hardy enough to tolerate a broad range of environmental conditions, and requires no elaborate sterile culture conditions. The data presented demonstrates the high sensitivity of the system to gaseous compounds and the relatively short time from start of exposure to definition of results (3 weeks). In the absence of hard genetic evidence for extrapolation from plants to man, at least this system can become part of a battery of tests which can provide early warning of the potential health hazard of exposure to mixed air pollutants.

47220 **Determination of atmospheric gaseous and particulate sulfur compounds.** Tanner, R.L.; Forrest, J.; Newman, L. (Brookhaven National Lab., Upton, NY). pp 371-452 of Sulfur in the environment. Part 1. The atmospheric cycle. Nriagu, J.O. (ed.). New York, NY; John Wiley and Sons Inc. (1978). Contract AC02-76CH00016.

Gaseous sulfur compounds, including sulfur dioxide, hydrogen sulfide, and organic sulfur compounds, are the first category treated in this discussion of the monitoring, sampling, and measuring methods of sulfur air pollutants. Particulate sulfur compounds are also discussed. A final section is devoted to applications of sulfur dioxide and sulfate measurements to atmospheric chemistry. Emission and transformation of sulfuric acid particles from catalyst-equipped automobiles and sulfur dioxide to sulfate conversion studies are treated as separate parts of that discussion. 305 references, 10 figures.

47221 **Dispersal models for sulfur oxides in urban environments.** Brubaker, K.L.; Rote, D.M. (Argonne National Lab., IL). pp 171-241 of Sulfur in the environment. Part 1. The atmospheric cycle. Nriagu, J.O. (ed.). New York, NY; John Wiley and Sons Inc. (1978).

Urban meteorology is reviewed. Temperature fields, turbulence intensity, and wind fields are discussed as part of the review. Removal and transformation processes (dry deposition, precipitation scavenging, and chemical transformation) are discussed. Source types and emission models are discussed with regard to sulfur oxide emissions. Urban dispersion models are discussed. Plume models and Puff models are treated in a discussion of Gaussian models; numerical models are also dealt with. Urban $SO_2$ model verification studies are reviewed. 143 references, 3 figures, 7 tables.

47222 **Improved method of estimating concentrations and related phenomena from a point source emission.** Smith, M.E.; Singer, I.A. (Brookhaven National Lab., Upton, NY). *Journal of Applied Meteorology;* **5**: 631-639(Oct 1966).

The meteorological features of a refined air pollution evaluation technique are described. Time and space variations of wind speed, dispersion parameters and capping inversions are permitted, and it is believed that the estimates of dispersion at large distances from the source are more realistic than those obtained with simple models. 9 references, 8 figures, 1 table.

## 5003 Radioactive Materials Monitoring And Transport

*REFER ALSO TO CITATION(S) 46029, 46211, 46215, 46218, 46219, 46537, 47070, 47077, 47204, 47867*

47223 **(AERE-HP/M—87) Correction for the absorption of plutonium alpha particles in filter paper used for dust sampling.** Simons, J.G. (UKAEA Atomic Energy Research Establishment, Harwell). 1956. 8p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85901936.

This sample of air-borne dust collected on a filter paper when laboratory air is monitored for plutonium with the 1195 portable dust sampling unit may be regarded, for counting purposes, as a thick source with a non-uniform distribution of alpha-active plutonium. Experiments have been carried out to determine a correction factor to be applied to the observed count on the filter paper sample to correct for internal absorption in the paper and on the dust layer. From the results obtained it is recommended that a correction factor of 2 be used.

47224 (CONF-791122—Absts., pp 33) **Determination of fallout nuclides and environmental radioactivity monitoring in the period 1974-1979.** Lin Yu-Ming; Chang Mei-Fung; Shen Yu-Chia (Taiwan Radiation Monitoring Station, Atomic Energy Council of Executive Yuan). 1979. NTIS (US Sales Only), PC A04/MF A01. File Number DE82904129. (INIS-mf—9485).

From 2. Asian regional congress on radiation protection; Manila, Philippines (5 Nov 1979).

Published in abstract form only.

47225 **(EUR—9128) Atmospheric transport of radioisotopes and the assessment of population doses on a European scale. Application of the MESOS code to the meteorological dispersion of radioactive discharges from national nuclear sites in the European Community with particular reference to the mesoscale.** ApSimon, H.M.; Goddard, A.J.H. (Commission of the European Communities, Luxembourg). 1983. 471p. Commission of the European Communities, Luxembourg.

A model, called MESOS, to predict the medium to long range transport and dispersal of atmospheric releases of radionuclides, was developed. This model uses data derived from standard meteorological observations to follow the trajectories and dispersion of material released. It takes into account the evolving meteorological conditions in the boundary layer of the atmosphere, the synoptic scale wind, the intensity and duration of rain, etc. In order to apply the model to Western Europe, meteorological data-bases providing the relevant information at three-hourly intervals have been compiled. The model has been used to compute the dispersal of hypothetical unit releases of selected radionuclides from five different source locations in different EC countries. The effects of continuous annual releases were simulated by suitably averaging the results for air exposure and for wet and dry deposition in order to permit the drawing of collective dose contour maps, using data grids of population distribution and food production. At selected receptor points around each source, the levels of contamination were calculated and analysed in the form of frequency or cumulative probability distributions. Illustrative results are presented to show the potential application of the MESOS model for the evaluation of possible long-range consequence of accidental releases.

47226 (INIS-mf—9758, pp vp) **About seasonal variations effect on radon concentration in small houses.** Winqvist, K. (Straalsaekerhetscentralen, Helsingfors, Finland). 1984. (In Swedish). NTIS (US Sales Only), PC A08/MF A01. File Number DE85781601. (CONF-8410282—Absts.).

From 7. Nordic Society for Radiation Protection ordinary meeting; Copenhagen, Denmark (10 Oct 1984).

Published in summary form only.

47227 (INIS-mf—9758, pp vp) **Radon 226 and lead 210 concentration in vicinity of uranium mineralization and on reference sites in North Finland.** Rissanen, K. (Straalsaekerhetscentralen, Helsingfors, Finland). 1984. (In Swedish). NTIS (US Sales Only), PC A08/MF A01. File Number DE85781601. (CONF-8410282—Absts.).

From 7. Nordic Society for Radiation Protection ordinary meeting; Copenhagen, Denmark (10 Oct 1984).

Published in summary form only.

47228 (INIS-mf—9758, pp vp) **Dry deposition in urban areas.** Roed, J.; Gjoerup, H.L. (Risoe National Lab., Roskilde (Denmark)). 1984. NTIS (US Sales Only), PC A08/MF A01. File Number DE85781601. (CONF-8410282—Absts.).

From 7. Nordic Society for Radiation Protection ordinary meeting; Copenhagen, Denmark (10 Oct 1984).

In order to facilitate developing a model for deposition in urban areas, beryllium-7, created by cosmic radiation and fall-out cesium-137, have been used as tracers in measurements designed to find the dry deposition velocity on building surfaces. A literature review has revealed that very little work has been done on deposition in urban areas; therefore, a major effort on measuring the deposition parameter is needed to construct reliable models in this field. Deposition velocities in the range from 0.001-0.04 cm/s have been found. (author).

47229 (INIS-SU—301, pp 48-52) **Working out the recommended and standard reference data for problems of calculation of neutron fields and attendant effects in the Earth atmosphere and in environments with basic soil-forming elements.** Trukhanov, G.Ya. 1984. (In Russian). NTIS (US Sales Only), PC A18/MF A01. File Number DE85781590. (CONF-8310228—).

From 6. Soviet national conference on neutron physics; Kiev, USSR (10 Oct 1983).

The problem of developing recommended and standard inquiry data (RSD and SID) for problems of neutron transfer in the Earth atmosphere and in media of rock-forming elements is discussed. A scheme of non-linear iteration process in the frames of which RSD and SID output takes place is presented. Importance of correct formulation of requirements to precision of nuclear data is pointed out. RSD are developed by total neutron cross sections of hydrogen, carbon, nitrogen, oxygen, calcium and they are included in the Atmosphere-Earth data bank.

47230 **(MIUU—75) Analysis of turbulence and wind measurements at the Naesudden peninsula during two periods with near-neutral stratification.** Hoegstroem, U. (Uppsala Univ. (Sweden). Meteorologiska Institutionen). 1984. 24p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85702135.

Turbulence measurements and wind measurements performed during two autumn campaigns in 1980 and 1982 at the Naesudden peninsula WECS site have been analysed. The turbulence measurements have been taken at three levels in the 145 m mast: 11 m, 77 m and 134 m. To a large extent near neutral stratification prevailed in both measurement campaigns. Because of this the influence of terrain inhomogeniety (i.e. the presence of an extended wooded areas at 1 to 2 km distance in one direction and of surrounding water areas at a similar distance for a large sector) on turbulence and wind can be studied in some detail. It is found that entirely undisturbed conditions prevail only for a rather narrow sector of northerly winds. For winds from most other sectors studied (40degree - 180degree) a moderate influence of terrain inhomogeniety is noticed in the studied turbulence quantities at 77 and 134 m. Highly anomalous conditions are found during an extended period (the measurement covered two days) in 1980 when the wind reaching the peninsula had an undisturbed over water fetch of several hundred kilometers: The wind profile was characterized by a maximum at 75 - 100 m above the surface. This feature was temporarily destroyed for a period of several hours when the wind turned less than 30 degrees to a direction (150degree - 180degree) where the flow had to pass a narrow strip of land (a few kilometers). The possible mechanism for this low level jet is discussed. It is suggested that frictional decoupling at the upwind coastline (some hundred

kilometers away) may cause an inertial oscillation. It is, however, not claer at this stage whether such a phenomenon can 'survive' travel for several hours in neutrally stratified air as prevailed in this case.

47231 **(RISO-M—2475) Literature review on wet deposition.** Heikel Vinther, F.; Nielsen, O.J. (Risoe National Lab., Roskilde (Denmark)). Dec 1984. 21p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85702136.

The literature on wet deposition or precipitation scavenging have been reviewed with special reference to predicting the radiological consequences of accidental contamination. The work was part of the EEC Radiation Protection Programme and done under a subcontract with Association Euratom-C.E.A. No. SC-014-BIAF-423-DK(SD).

47232 **(SCPRI-RM—11-1984) Monthly results of measurements. November 1984.** (Service Central de Protection contre les Rayonnements Ionisants, 78 - Le Vesinet (France)). Dec 1984. 32p. (In French). NTIS (US Sales Only), PC A03/MF A01. File Number DE85752164.

Measurement tables concerning the surveillance of the environment (see also the SCPRI-RT--4-1984 report).

47233 **Krypton-85 purge at Three Mile Island: a comparison of measured and calculated surface air concentrations.** Kunz, C.; Wahlen, M.; Peterson, K.R.; Rodriguez, D.J. (Lawrence Livermore National Lab., CA). *Health Physics;* **49**: No. 3, 522-526(Sep 1985).

During the accident at Three Mile Island (TMI) Unit No. 2 pressurized water reactor in March 1979, approximately 45,000 Ci of $^{85}$Kr were trapped in the reactor building. Between 28 June and 11 July 1980, the $^{85}$Kr was released through the plant vent at a controlled, measured rate. This purge offered an opportunity to test model estimates of the $^{85}$Kr dispersion with measurements of surface air concentrations. During the purge, the US Environmental Protection Agency (EPA) collected daily air samples for $^{85}$Kr measurements within 8.5 km of TMI. Lawrence Livermore National Lab., (LLNL) used computer models in real time to generate hourly $^{85}$Kr concentration-contour maps, which were used to position EPA mobile sampling units. To evaluate the LLNL models at greater distances, the Radiological Sciences Laboratory (RSL) of the New York State Department of Health measured $^{85}$Kr concentrations on 8 July 1980, toward the end of the purge, at sites ranging from 36-63 km from the reactor. The measured concentrations were compared to the results of model calculations that were subsequently performed by LLNL.

## 5005 Site Resource And Use Studies

47234 **(LA-UR—85-2887) Numerical simulations of valley ventilation and pollutant transport.** Yamada, T. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 9p. (CONF-851177—2). NTIS, PC A02/MF A01; GPO Dep. File Number DE85017555.

From 7. symposium on turbulence and diffusion of the AMS; Boulder, CO, USA (12 Nov 1985).

As a part of the siting methodology task for the DOE oil shale project the Los Alamos National Laboratory three-dimensional atmospheric models were used to assess potential environmental problems associated with future development of oil shale energy in Colorado. An area of 200 km x 200 km centered at Brush Creek, Colorado, where the ASCOT conducted extensive meteorological and tracer experiments in September/October 1984, was chosen as an initial simulation area. In this paper, preliminary simulations of the mean wind, turbulence, and nonreactive tracer transport are presented, where very little input data were available. Since data to compare with are not available, we discuss only qualitatively the model capability to produce: (1) complex airflow generated by differential heating and cooling over sloped surfaces; (2) strong diurnal variations in wind speed, wind direction, and atmospheric turbulence; and (3) enhanced daytime ventilation in a valley. The hydrodynamic model used to compute wind and turbulence is reviewed in Section 2 where a brief description of boundary and initial conditions, and numerical procedures are also included. Examples of the computed wind and turbulence distribution are given in Section 3. A random-particle statistical diffusion model is used to simulate tracer transport and diffusion where the computed wind and turbulence fields are utilized to determine tracer locations. 5 refs.

## 5006 Regulations

*REFER ALSO TO CITATION(S) 47401*

47235 **(NP—5752627) Act no. 251 on reducing sulfur dioxide pollution from power plants.** (Danmarks Tekniske Hoejskole, Lyngby. Lab. for Varmeisolering). 23 May 1984. 2p. (In Danish). Danmarks Tekniske Hoejskole, Lyngby. Lab. for Varmeisolering.

The act states that the electric utilities in Denmark each year must report to the Ministry of Energy on information necessary to evaluate the emission quantity of sulfur dioxide from power plants. Each year the Ministry of Environment lays down the maximum amount of the legal sulfur dioxide emission from Danish power plants.

47236 **(SNV-PM—1850) Particle emissions from heavy fuel oil combustion. Application of the guidelines for air management 1973:8.** Hanell, B. (Statens Natuurvaardsverk, Solna (Sweden)). Apr 1984. 11p. (In Swedish). NTIS (US Sales Only), PC A02/MF A01. File Number DE85752547.

Complementary instructions to the National Swedish Environmental Protection Boards Guidelines for air management published in SNV-1973-8 and Measurement of particles in emissions to air from stationary sources SNV-PM-1821 are given. Sampling-, measurement-, and evaluation methods are described. The aim of this publication is to facilitate the handling of questions concerning particle emissions from heavy fuel oil combustion for industry and public authorities.

47237 **(STEV-FBA—85-1) Cost of restrictive measures against sulfur and NOsub(X).** Persson, K. (Statens Energiverk, Stockholm (Sweden)). 1984. 72p. (In Swedish). NTIS (US Sales Only), PC A04/MF A01. File Number DE85752535.

When peat is fired in a fluidized bed, the emission of sulfur can be reduced to 0.05 g S per MJ by means of limestone addition at a cost of 0.001 SEK per KWh. Desulfurizing of flue gases will be expensive and can be calculated to 0.01 to 0.02 SEK per KWh. The cost of NOsub(X) reduction by 40% to 60% is calculated to 0.002 to 0.003 SEK per KWh. Higher reduction levels will require catalytic processes and the cost will increase to 0.015 SEK per KWh. All the figures are approximative because of very few applications of peat firing.

47238 **(STEV-FBA—85-2) Characteristics of existing emission standards for the combustion of wet fuels.** Gunnarsson, N.A. (Statens Energiverk, Stockholm (Sweden)). Oct 1984. 8p. (In Swedish). NTIS (US Sales Only), PC A02/MF A01. File Number DE85752536.

The standards valid for peat firing and the corresponding combustion methods have been studied. The existing problems when energy is recovered from wet flue gases by condensation have been investigated.

# 51 ENVIRONMENTAL SCIENCES, TERRESTRIAL

## 5101 Basic Studies

*REFER ALSO TO CITATION(S) 46148, 46157, 46158, 47271*

47239 **(CONF-8506179—1) Application of environmental risk analysis to engineered organisms.** Suter, G.W. II. (Oak Ridge National Lab., TN (USA)). 1985. Contract AC05-84OR21400. 32p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85016377.

From Engineered organisms in the environment: a cross-disciplinary symposium; Philadelphia, PA, USA (10 Jun 1985).

Although many of the models, test systems, and assessment approaches currently used for environmental risk analysis of chemicals will be applicable to engineered organisms, the ability of organisms to reproduce and their requirement of a suitable habitat in order to persist and function create additional assessment problems. Existing methods can address the initial release and dispersal of an organism but cannot predict the likelihood of the population finding a suitable habitat or of dispersing between suitable habitats. Although applicable pathogenicity tests exist, the probability of undesired pathogenicity cannot be predicted either before or after testing. Tests for effects of ecosystem processes may be based on existing microcosms but will to be adapted to the organism and the hypothesized effect. Because of the specificity of an organism's habitat requirements and effects on the habitat, it is difficult to generalize results between test systems. Therefore, it will be necessary to devote considerable attention to the logic of the assessment process in order to make defensible predictions about the fate and effects of an engineered organism without excessive expenditure of time and money. 42 refs., 1 figs.

47240 **(SNV-PM—1869) Effects of experimental acidification and liming on the transformation of carbon, nitrogen and sulphur in forest soils.** Noemmik, H.; Larsson, K.; Lohm, U. (Statens Natuurvaardsverk, Solna (Sweden)). Sep 1984. 49p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85752542.

The purpose of this study was to examine the effects of experimental acidification, and of liming, on both the mineralization-immobilization dynamics of selected bioelements in specified soil horizons, and the retention and the desorption mechanisms of sulphate. Results of the incubation study indicate that in soils, subjected to long-term field treatment with sulphuric acid, the total microbial activity, as measured by $CO_2$ by isotopic exchange, was reduced. In humus materials from a number of field trials, the lime treatment showed a negative effect on the accumulation of mineral nitrogen, whereas the mineralization of carbon was enhanced. The above effects were most marked in mor humus, characterized of high C/N ratios, whereas they were non existing in mineral soil from corresponding soil profiles. The capacity of the forest humus to netmineralize sulphur was low in general. In short-term incubation they immobilized sulphur, applied as cysteine or sulphate. The B-horizon of the podsol profiles had considerable capacity to retain sulphate. The retention capacity displayed its maximum at pH 3.4-3.6. Furthermore, it was positively related to the content of dithionite extractable aluminium and iron in the soil material. The rate of redistribution of added $^{109}Cd$ to deeper soil horizons was enhanced both by acid treatment and prolonged observation period.

## 5102 Chemicals Monitoring And Transport

*REFER ALSO TO CITATION(S) 46399, 46709, 46835, 47141, 47215, 47275, 47278, 47285*

47241 **(RHO-ML-SA—3) Hazardous waste management at Rockwell Hanford Operations.** McCall, D.L. (Rockwell International Corp., Richland, WA (USA). Rockwell Hanford Operations). Nov 1984. Contract AC06-77RL01030. 6p. (CONF-841275—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85015393.

From DOE and DOE contractors' radioactive and hazardous material packaging workshop; Germantown, MD, USA (4 Dec 1984).

The control of hazardous wastes at the Hanford Site is a complex task and one that requires cooperation from each of the site operating contractors. The Rockwell Hanford Operations (Rockwell) Hazardous Waste Management Program being conducted at the Hanford site is described briefly in the following paragraphs. The program, as described, is an evolving program that is changing continually to improve control, enhance safety, and achieve full regulatory compliance. The Rockwell Hazardous Waste Management Program can be divided into three parts: (1) the control of hazardous materials; (2) the identification of hazardous waste streams; and (3) the disposal of hazardous wastes. These three parts and how they interface to provide an effective Hazardous Waste Management Program are described in the following text.

47242 **(SNV-PM—1851) Effects of different liming agencies in forests. A literature review.** Nihlgaard, B.; Budimir, P. (Statens Natuurvaardsverk, Solna (Sweden)). Jul 1984. 90p. (In Swedish). NTIS (US Sales Only), PC A05/MF A01. File Number DE85752538.

In the introduction of this report the different reasons for acidification of forest soils are summarized. The buffering systems of the soil are reviewed: the carbonate, silicate, aluminium and the iron buffering systems and the cation exchange system. Results of soil acidification are mentioned. Different liming agencies in use are described. Changes in the chemical soil processes due to liming are described. From a soil biology point of view liming means that the turnover of carbon and nitrogen is increased, with lowered C/N-ratio as a consequence. The tree production might be influenced, sometimes strongly positively but more often with slightly lowered volume production. This decrease is mainly interpreted as a result of disturbed mycorrhiza, possibly a negative nitrate-effect, and sometimes as a relative magnesium or bor deficiency. Increased production seems mainly to appear when liming is done in young stands or before reforestation. The conclusions are - that liming has a long term positive effect on the chemical soil status in preventing the resolution of aluminum and other metals, subsequently with positive effects on the soil and ground water in the long run - that one has to be careful with liming in old stands, in order not to get a decreased volume production - that one probably has to compensate for the acidification leaching effects in the soil by adding eg magnesium and bor together with lime in many forest soils.

47243 **(SNV-PM—1853) pH in Swedish forest soils.** Troedsson, T.; Nilsson, Aa. (Statens Natuurvaardsverk, Solna (Sweden)). Jul 1984. 28p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85752540.

A survey of forest site conditions has been carried out in collaboration with the National Forest Survey in Sweden. The survey has been done as an annual strip mapping of the productive forest area in Sweden. In this investigation the relationships between pH in the humuslayers ($A_0$) and other site factors are given in 20 coloured maps and based upon soil analysis from 27 000 sample plots. Some of the site properties are soil type, soil genesis, soil depth soil horizons, soil moisture, tree species, the age of the tree stand etc.

47244 **Process for removing polychlorinated biphenyls from soil.** Hancher, C.W.; Saunders, M.B.; Googin, J.M. (to Dept. of Energy). US Patent Application 6-672,230. 16 Nov 1984. 10p. Contract AC05-84OR21400. DE85017770 NTIS, PC A02/MF A01; GPO Dep. File Number DE85017770.

The present invention relates to a method of removing polychlorinated biphenyls from soil. The polychlorinated biphenyls are extracted from the soil by employing a liquid organic solvent dispersed in water in the ratio of about 1:3 to 3:1. The organic solvent includes such materials as short-chain hydrocarbons including kerosene or gasoline which are immiscible with water and are nonpolar. The organic solvent has a greater affinity for the PCB's than the soil so as to extract the PCB's from the soil upon contact. The organic solvent phase is separated from the suspended soil and water phase and distilled for permitting the recycle of the organic solvent phase and the concentration of the PCB's in the remaining organic phase. The present process can be satisfactorily practiced with soil containing 10 to 20% petroleum-based oils and organic fluids such as used in transformers and cutting fluids, coolants and the like which contain PCB's. The subject method provides for the removal of a sufficient concentration of PCB's from the soil to provide the soil with a level of PCB's within the guidelines of the Environmental Protection Agency.

47245 **Effects of acid irrigation on carbon dioxide evolution, extractable nitrogen, phosphorus, and aluminum in a deciduous forest soil.** Johnson, D.W.; Todd, D.E. (Oak Ridge National Lab., TN). *Soil Science Society of America Journal;* **48**: 664-666(1984). Contract W-7405-ENG-26.

A study was initiated to determine the effects of sulfuric and nitric acid irrigation on $CO_2$ evolution, and N, P, and Al availability in a deciduous forest soil. Irrigation with $H_2O$, $H_2SO_4$, or $HNO_3$ at 0.05 mol $(p^+)$ $m^{-2}$ and 0.5 mol $(p^+)$ $m^{-2}$ for 1 yr had no consistent effect on $CO_2$ evolution, soil $NH_4^+$, extractable P, or extractable Al in a deciduous forest soil under field conditions. Irrigation with $HNO_3$ caused temporary increases in soil $NO_3^-$, but irrigation with $H_2SO_4$ had no effect on soil $NO_3^-$. Nitrogen mineralization and nitrification by aerobic incubation were also unaffected by treatments. Seasonal variations in $CO_2$ evolution, $NH_4^+$, and extractable P were pronounced, with peaks in $CO_2$ evolution, $NH_4^+$, in June and a peak extractable P in August. 19 references, 2 tables.

47246 **Ecosystem-level effects of sulfur deposition: overview.** Kelly, J.M. (Oak Ridge National Lab., TN). pp 375-376 of Atmospheric sulfur deposition: environmental impact and health effects. Shriner, D.S.; Richmond, C.R.; Lindberg, S.E. (eds.). Ann Arbor, MI; Ann Arbor Science (1980). (CONF-791090—).

From Symposium on potential environmental and health effects of atmospheric sulfur deposition; Gatlinburg, TN, USA (14 Oct 1979).

A general discussion is presented of the value of ecosystem level studies of air pollution effects. Studies carried out at the species level and community level provide information for analyses carried out at the ecosystem level. The papers presented in the section for which this paper is an overview provide some excellent examples of both species/process and community/subsystem approaches to the effects of sulfur deposition.

## 5103 Radioactive Materials Monitoring And Transport

*REFER ALSO TO CITATION(S) 46172, 46190, 46198, 46208, 46208, 46210, 46211, 46217, 46219, 46537, 47065, 47066, 47067, 47069, 47227, 47229, 47232, 47278, 47363, 47368*

47247 (CONF-791122—Absts., pp 31) **Environmental radiation monitoring at PNC Tokai Works.** Fukuda, S.; Kitahara, Y.; Kishimoto, Y.; Shinohara, K.; Katoh, J. (Power Reactor and Nuclear Fuel Development Corp., Tokai, Ibaraki (Japan). Tokai Works). 1979. NTIS (US Sales Only), PC A04/MF A01. File Number DE82904129. (INIS-mf—9485).

From 2. Asian regional congress on radiation protection; Manila, Philippines (5 Nov 1979).

Published in abstract form only.

47248 (CONF-791122—Absts., pp 41) **Technologically enhanced or diminished radiation background of Taiwan.** Weng Pao-Shan (Nuclear Science and Technology Development Center, National Tsing Hua Univ., Hsinchu, Taiwan). 1979. NTIS (US Sales Only), PC A04/MF A01. File Number DE82904129. (INIS-mf—9485).

From 2. Asian regional congress on radiation protection; Manila, Philippines (5 Nov 1979).

Published in abstract form only.

47249 **(EUR—9065) European seminar on the risks from tritium exposure. Proceedings.** Gerber, G.; Myttenaere, C. (ed.). (Commission of the European Communities, Luxembourg). 1984. 356p. (CONF-821167—). Commission of the European Communities, Luxembourg.

From European seminar on the risks from tritium exposure; Mol, Belgium (22 Nov 1982).

Tritium is produced in appreciable amounts in nuclear installations and some of it is released during normal operation of reactors and during reprocessing. Unplanned discharges may occur during accidents. Moreover, the amounts of tritium which must be handled will increase substantially when nuclear fusion becomes operative. Although tritium is not considered a particularly toxic radionuclide, it possesses certain characteristics which need more detailed study: tritium is transported readily through the environment and, in this process, can be incorporated into organic molecules whose metabolism in the body and dose distribution in the cell may differ markedly from that of tritium water. Moreover, tritium may also be released in elementary form and undergoes various chemical and metabolic transformations. In view of the diversified aspects of the possible impact of tritium on man, close co-operation is required between persons planning nuclear development, radioecologists, scientists carrying out dosimetry and radiobiologists. The European seminar on the risks from tritium exposures which was organized jointly by the Commission of the European Communitities and the Belgian Nuclear Centre (Mol, Belgium, 22-24 November 1982) has brought together scientists from all these disciplines and covered the entire range of problems connected with tritium risks. The present proceedings of the seminar should help to define those areas where our knowledge is still deficient, i.e. pathways of organic and elementary tritium to man, and hopefully should also stimulate cooperation between different countries.

47250 (INIS-mf—9758, pp vp) **Calculated and measured activity in sedimentary material.** Blomqvist, L. (Straalsaekerhetsinstitutet, Helsingfors, Finland). 1984. (In Swedish). NTIS (US Sales Only), PC A08/MF A01. File Number DE85781601. (CONF-8410282—Absts.).

From 7. Nordic Society for Radiation Protection ordinary meeting; Copenhagen, Denmark (10 Oct 1984).

Published in summary form only.

47251 (INIS-mf—9758, pp vp) **Calibration of instruments for measurements of natural environmental gamma radiation and fallout.** Arvela, H. (Finnish Centre for Radiation and Nuclear Safety, Helsinki, Finland). 1984. NTIS (US Sales Only), PC A08/MF A01. File Number DE85781601. (CONF-8410282—Absts.).

From 7. Nordic Society for Radiation Protection ordinary meeting; Copenhagen, Denmark (10 Oct 1984).

The main areas of environmental dose rate measurements in Finland are the studies of the natural background radiation, especially in areas where exposure to $^{222}Rn$ is studied, and the control measurements around nuclear installations. Some of the instruments used normally for measurements of natural environmental gamma radiation will be used also during emergencies for measurements of radioactive fallout. If various types of instruments are used the responses to the radiation field measured should be known to achieve comparable results and avoid incorrect conclusions. (author).

47252 (INIS-SU—299, pp 126-127) **Results of geochemical and geophysical investigations in Kola superdeep hole.** Karus, E.V. (Vsesoyuznyj Nauchno-Issledovatel'skij Inst. Geofizicheskikh Metodov Razvedki, Moscow (USSR)). 1984. (In Russian). NTIS (US Sales Only), PC A17/MF A01. File Number DE85781599. (CONF-840820—Vol.9-Pt.1-Summs.).

From 27. international geological congress; Moscow, USSR (4 Aug 1984).

Short note.

47253 **(PAEC(C)IB—81012) Panay car-borne radiometric and geochemical surveys.** Santos, G. Jr.; Samonte, C.; Almeda, R.; Ranes, R.; Salvado, J.; Miguel, J. (Philippine Atomic Energy Commission, Diliman, Quezon City). Sep 1981. 11p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85702123.

A car-borne radiometric survey and stream sediments collection were conducted in Panay and Guimaras Islands. An area in Nabas, Aklan, situated in the northwestern tip of Panay (Buruanga Peninsula) which indicated 2 to 3 times above background radioactivity was delineated. Uranium content in the stream sediment samples collected from Buruanga Peninsula was generally higher than those obtained in other parts of the island. Radioactivity measurements and uranium content in stream sediments were found to be within background levels. It is recommended that follow-up radiometric and geochemical surveys be undertaken in Buruanga Peninsula and additional stream sediments samples be collected in Panay to achieve better sampling density and coverage.

47254 **(PNL-SA—7655) Some statistical lessons learned in Eniwetok.** Barnes, M. (Pacific Northwest Labs., Richland, WA (USA)). Apr 1979. Contract AC06-76RL01830. 6p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85017662.

The report discusses some statistical design and analysis aspects of the cleanup of transuranic contamination on the Eniwetok Atoll. The importance of clear, complete definitions not only of statistical variables, but also of decision guidelines is stressed. Also discussed is the fact that definitions and decisions often cannot be made on a statistical basis, but are of necessity matters of policy. 1 ref. (ACR)

**47255 (RISO-R—487) Environmental radioactivity in Denmark in 1982.** Aarkrog, A.; Boetter-Jensen, L.; Dahlgaard, H.; Hansen, H.; Lippert, J.; Nielsen, S.P. (Risoe National Lab., Roskilde (Denmark)). Jun 1983. 145p. NTIS (US Sales Only), PC A07/MF A01. File Number DE85702122.

Strontium-90 was determined in samples from all over the country of precipitation, ground water, drinking water, sea water, dried milk, grain, bread, potatoes, vegetables, fruit, total diet, and human bone. Furthermore, $^{90}Sr$ was determined in local samples of air, rain water, marine sediments, grass, sea plants, fish and meat. Cesium-137 was determined in air, precipitation, sea water, sediments, milk, grain products, potatoes, vegetables, fruit, total diet, sea plants, fish, and meat. Estimates of the mean contents of radiostrontium and radiocesium in the human diet in Denmark during 1982 are given. Tritium was determined in precipitation, fresh water and sea water. Plutonium and Americium were measured in marine samples. The γ-background was measured regularly by TLD, ionization chamber and on site γ-spectroscopy at locations around Risoe, at ten of the State experimental farms, along the coasts of the Great Belt and around Gylling Naes. The marine environments at Barsebaeck and Ringhals were monitored for $^{137}Cs$ and corrosion products ($^{58}Co$, $^{60}Co$, $^{65}Zn$, $^{54}Mn$).

**47256 (SKBF-KBS-TR—83-73) Uranium, thorium and radium in soil and crops. Calculation of transfer factors.** Evans, S.; Eriksson, Aa. (Swedish Nuclear Fuel Supply Co., Stockholm. Div. KBS). Jun 1983. 68p. NTIS (US Sales Only), PC A04/MF A01. File Number DE85701865.

With 12 refs. .

The distribution of the naturally occurring radionuclides uranium, thorium and radium in soil, plant material and drainage water was evaluated. The plant/soil concentration factors showed that very small fractions of the nuclides were available for the plants. The water/soil concentration factors were calculated; the nuclide content in drainage water generally indicated very low leaching rates. The distribution of the radionuclides was utilized with the aim to obtain reliable concentration factors which in turn could be used to calculate the transfer of nuclides within the agricultural ecosystem. Dose calculations were performed using plant/soil concentration factors based on geometric mean values.

**47257 (SLU-REK—56) Ploughing in simulated radioactive layer on farming solid. Methods and effects.** Nilsson, J. (Swedish Univ. of Agricultural Sciences, Uppsala. Dept. of Radioecology). Sep 1983. 30p. (In Swedish). NTIS (US Sales Only), PC A03/MF A01. File Number DE85702143.

In case of a nuclear disaster, farmland would be contaminated by nuclear fallout. The possibilities of restoring such land by different means is under investigation at the Department of Radioecology. One of these means is mouldboard ploughing for placing a contaminated surface layer deep in comparison to the subsequent soil managment operations. The placement efficiencies obtained under varying experimental conditions are given in this report. Different widths of cut, working depths and driving speeds have been studied as well as different jointers, a foreplough and a trash board. A double-depth plough, a -parallellplough- and a plough with a deep-digging body were included in the test. Large cutting width and great working depth proved benficial, while neither use jointers, foreplough, trash board nor changes in driving speed had any apparent effect on the result of the ploughing. The double-depth plough worked as well as a conventional plough with the same width of cut, while the -parallellplough- did not perform well. The best results were experienced with the deep-digging body (cutting width 600 mm, 24) when used at great working depth (500 mm, 20). This type of plough is, however, rare in Sweden.

## 5105 Site Resource And Use Studies

*REFER ALSO TO CITATION(S) 45988, 45989, 45991, 46213, 46214*

**47258 (DOE/ER—0246) Department of Energy National Environmental Research Parks.** (USDOE Office of Energy Research, Washington, DC. Office of Health and Environmental Research). Aug 1985. 51p. NTIS, PC A04/MF A01; GPO Dep. File Number DE85017978.

Five DOE sites have been designated as Environmental Research Parks. These sites have been valuable for research concerning plant succession, biomass production, radionuclide cycling, demonstration of costs and effectiveness of recolonization of disturbed lands, thermal affects in freshwater ecosystems, and for research training of students. This report provides brief descriptions of the Savannah River Plant, Idaho National Engineering Laboratory, Hanford Reservation, Los Alamos, and Oak Ridge Reservation. Research programs conducted at each site are also described. (ACR)

**47259 (DOE/ER/60297—1) Compensatory mortality in mule deer populations. Technical progress report.** White, G.C. (Colorado State Univ., Fort Collins (USA). Dept. of Fishery and Wildlife Biology). 31 Aug 1985. Contract FG02-85ER60297. 11p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85017618.

In the fall of 1984 sixty fawns were radio collared on both the C-b Tract and Little Hills study areas, bringing the total instrumented population in Piceance Basin to 160 at the onset of winter. Deer show strong fidelity to both their individual summer and winter ranges and appear to use the same migratory route to travel between the two. Adult doe winter survival was 85% for the instrumented C-b Tract population and 100% for Little Hills animals. Fawn survival was 9% for the C-b Tract animals and 31% for Little Hills animals. The high fawn mortality for C-b Tract animals is attributed to an increase in predation rates from an average of 44% of the instrumented population during winters 1980 to 1981 through 1983 to 1984 to 77% this past winter. Both coyotes and bobcats were responsible for the increased predation. For the third consecutive year at least 40 to 50% of the instrumented fawns in the Little Hills area succumbed to starvation. These relatively high losses even during "normal" winters (1982 to 1983 and 1984 to 1985) suggest that adequate forage may not be available for the number of deer wintering on the Little Hills range. 1 fig., 2 tabs.

**47260 (LA—8050-NERP-Vol.3) Status of the flora of the Los Alamos National Environmental Research Park. Checklist of vascular plants of the Pajarito Plateau and Jemez Mountains. Volume 3.** Foxx, T.S.; Tierney, G.D. (Los Alamos National Lab., NM (USA)). Jun 1985. Contract W-7405-ENG-36. 148p. NTIS, PC A07/MF A01; GPO Dep. File Number DE85017704.

This report lists all taxonomic identifications recorded from the Pajarito Plateau Valles del los Sierros, Valles Caldera, and portions of the Jemez Plateau of the Jemez Mountains in north-central New Mexico. Approximately 900 plants representing more than 80 families are documented. 36 refs.

**47261 (PNL-SA—12895) Behavioral responses of birds of prey to large scale energy development in southcentral Washington.** Fitzner, R.E. (Pacific Northwest Labs., Richland, WA (USA)). Feb 1985. Contract AC06-76RL01830. 22p. (CONF-850296—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85016615.

From 2. biennial symposium on issues and technology in the management of impacted western wildlife; Glenwood, CO, USA (4 Feb 1985).

The types of raptorial and semi-raptorial birds that use the Hanford environs are discussed along with the impacts of past operations and the recent WPPSS project on their populations. These findings add to our understanding of the population dynamics of the birds of prey community at the Hanford Site and the expected impacts of the WPPSS energy facilities. The results may have implications toward other large scale energy facilities, and may aid us

in management of bird of prey communities throughout the grasslands of the western United States. 110 refs., 5 figs., 4 tabs.

### 5106 Regulations

*REFER ALSO TO CITATION(S) 46214, 47244*

## 52 ENVIRONMENTAL SCIENCES, AQUATIC

### 5201 Basic Studies

*REFER ALSO TO CITATION(S) 47239, 47284*

47262 (DOE/ER/60031—T1) **Research on the marine food chain. Final technical report.** Eppley, R.W. (California Univ., San Diego, La Jolla (USA). Inst. of Marine Resources). [1985]. Contract AS03-82ER60031. 334p. NTIS, PC A15/MF A01; 1; GPO Dep. File Number DE85013666.

This final report includes summaries of the Food Chain Research Group's extensive basic research in Southern California Bight waters and on planktonic organisms which are important components of the bight's pelagic food web. Additionally, the report conveys much of the information resulting from biological, chemical and physical oceanographic research by others active in the study of the pelagic realm of the Bight, especially that conducted during the last several decades. Hence, the book is intended to be a comprehensive description and analysis of the pelagic food web form and function in the Bight and of interactions between food web components and the environmental parameters affecting these. It is presented in a style intended to be informative to the layman as well as the scientist interested in the important coastal resources represented by the Southern California Bight.

47263 (DOE/ER/60031—T1, pp 1-16) **Introduction to the Southern California Bight.** Carlucci, A.F.; Eppley, R.W.; Beers, J.R. [1985]. NTIS, PC A15/MF A01. File Number DE85013666.

In Research on the marine food chain. Final technical report.

This report provides a brief orientation to the geography of the Southern California Bight, its bottom topography, climate, and its significance as a habitat for plankton. Related work in other research programs will be touched upon in order to provide a context for our studies. 7 figs.

47264 (DOE/ER/60031—T1, pp 17-55) **Physical oceanography of the Southern California Bight.** Jackson, G.A. [1985]. NTIS, PC A15/MF A01. File Number DE85013666.

In Research on the marine food chain. Final technical report.

Currents within the Southern California Bight, although part of the California Current system, are complicated and constrained by the regional bottom topography. Within the Bight there is a northward, near surface flow known as the Southern California Countercurrent. Water for this flow comes from water spun off by the California Current and from water from the south. Some of this Southern California Countercurrent water continues north at Point Conception to form the Davidson Current but most of it turns southward where it can mix with the California Current and reenter the Bight. The result is that the flow is a large counterclockwise eddy. Near the coast there is often a flow to the southeast. The strengths of all of these currents vary seasonally and non-seasonally. Deeper waters have their flow constrained to horizontal flow. As a result, water below 250 m is mostly southern in origin and the dominant exchange is to the south. Because many of the depressions (lower basins) are in low oxygen environments, oxygen concentrations and supply rates have been important tools in determining exchange rates. The purpose of this report is to describe these flow fields in more detail and to describe other physical processes of biologic interest. 22 figs., 1 tab.

47265 (DOE/ER/60031—T1, pp 57-88) **Chemistry of the dissolved and particulate phases in the water column.** Williams, P.M. [1985]. NTIS, PC A15/MF A01. File Number DE85013666.

In Research on the marine food chain. Final technical report.

A discussion is presented on the chemistry of the dissolved and particulate phases found within the water column (surface to 2000 m) at various locations in the Southern California Bight. This report provides baseline data for comparison of this open coastal environment with similar and dissimilar regions elsewhere for deciphering the various fluxes and cycles of organic and inorganic constituents throughout the water column, and to predict the fate of allochthonous but not necessarily anthropogenic terrestrial contaminants entering the coastal waters. 9 figs. (DT)

47266 (DOE/ER/60031—T1, pp 89-176) **Organisms and the food web.** Beers, J.R. [1985]. NTIS, PC A15/MF A01. File Number DE85013666.

In Research on the marine food chain. Final technical report.

The pelagic environment of the Southern California Bight has, especially in the last several decades, been the site of much study of its food web structure and dynamics. Trophic compartments extending from primary producers to top predators and encompassing components ranging from the smallest bacteria to the larger mammals have been the focus of research interest. This review considers primarily studies on the planktonic forms - including the bacterioplankton, protozooplankton, phytoplankton, and herbivorous and carnivorous metazooplankton - plus some representative (micro)nekton whose early life cycle stages are planktonic. 31 figs., 1 tab.

47267 (DOE/ER/60031—T1, pp 177-220) **Primary production in the Southern California Bight.** Eppley, R.W.; Holm-Hansen, O. [1985]. NTIS, PC A15/MF A01. File Number DE85013666.

In Research on the marine food chain. Final technical report.

This report is concerned with the main factors that influence the magnitude of primary productivity of the plankton, i.e., the rate of production of organic matter per unit area per unit time. We will concentrate on the phytoplankton which account for a large proportion of the primary production in the Southern California Bight. 21 figs., 2 tabs.

47268 (DOE/ER/60031—T1, pp 221-276) **Spatial and temporal scales and patterns.** Mullin, M.M. [1985]. NTIS, PC A15/MF A01. File Number DE85013666.

In Research on the marine food chain. Final technical report.

A review is presented of present knowledge of patterns in the California Bight, emphasizing phytoplankton and zooplankton (including larval fish), but including nutrients and bacteria. For phytoplankton and zooplankton, the review will cover patterns of some individual species as well as of total biomass. The summary will be restricted to data obtained within the Bight; this is an artificial distinction because many of the patterns are also known from other areas, and the processes underlying the patterns are of worldwide interest. 16 figs., 2 tabs.

47269 (DOE/ER/60031—T1, pp 277-292) **Nutrient cycling and foodweb dynamics in the Southern California Bight: the microbial foodweb.** Azam, F. [1985]. NTIS, PC A15/MF A01. File Number DE85013666.

In Research on the marine food chain. Final technical report.

Recent research in the Southern California Bight area has shown that the microbes play a major role in nutrient cycling. Heterotrophic bacterioplankton metabolism and growth consumes one-third to one-half of the primary productivity through the uptake of dissolved organic matter (DOM). Mineralization occurs during bacterial metabolism of DOM as well as during the trophic transfer of bacterial biomass along a "microbial loop." In general, because almost all DOM is used by bacterioplankton, they become the point

of injection of soluble organic pollutants, and to some extent radionuclides, etc., into the foodweb. 4 figs.

47270 **(DOE/EV/10611—5) Carbonate chemistry of the Bering Sea.** Chen, C.T.A.; Wei, C.L.; Rodman, M.R. (Oregon State Univ., Corvallis (USA). Coll. of Oceanography). Sep 1985. Contract AT06-81EV10611. 93p. NTIS, PC A05/MF A01; GPO Dep. File Number DE85017884.

Wintertime oxygen, pH, alkalinity and calcium profiles across the marginal ice zone of the central and southeastern Bering Sea shelf were analyzed and compared with summer data. During the winter, at water depths shallower than 75m, the water column is homogeneous and near freezing. Between the 75 and 200m isobaths the structure is essentially two-layered, a cool and fresh upper layer overlying a warmer, more saline bottom layer. The oxygen degree of saturation in most of the bottom mixed layer on the shelf in winter is higher than in the surface water in winter and the bottom water in summer. In summer the oxygen and carbonate data show extreme variability governed primarily by biological processes. Winter oxygen and carbonate data, however, do not scatter as much as the summer data and indicate conservative mixing of several sub-surface water masses. The winter surface water is undersaturated in both oxygen and carbon dioxide and seems to absorb oxygen, but little carbon dioxide, from the atmosphere. Alkalinity and calcium data show large river influence. All T/S and chemistry data indicate that the deep shelf water is a mixture of surface shelf water and surface Aleutian Basin water. Oxygen data indicate that the annual sea ice impedes, but does not stop, the air-sea exchange of gases. Excess $CO_2$ signal has been calculated based on our data and data from literature. The shelf water is saturated with excess $CO_2$ but it could not be detected below 1000 m in the Aleutian Basin. Altogether the Bering Sea contains $0.19 +- 0.05 \times 10^{15}$ g excess carbon. 24 figs.

47271 **(FWS/OBS—82/58-2) Ecological characterization of the Caloosahatchee River/Big Cypress watershed.** Drew, R.D.; Schomer, N.S. (Florida State Dept. of Environmental Regulation, Tallahassee (USA)). Sep 1984. 243p. NTIS, PC A11/MF A01. File Number TI85901999.

Southwest Florida contains a variety of natural resources that have contributed to the development of the area into an important industrial, shipping, agricultural, sport and commercial fishing, recreational, and retirement center in the eastern Gulf of Mexico. As growth continues the finite natural resources of the area will diminish in both quality and quantity. Future management of the remaining resources requires careful consideration to preserve a productive balance between man and nature. Often, in deciding where this line lies, there is considerable uncertainty about the composition, interaction, and value of the living resources in an area. This report is an extensive review and synthesis of the available literature on the ecology of the Caloosahatchee River/Big Cypress watershed. The report will be used by the US Fish and Wildlife Service, and the Mineral Management Service to plan for the development of oil and gas reserves offshore of southwest Florida. This document is divided into two parts. The first part describes the geology, physiography, climate, and the characteristics of ground and surface waters. The remainder of the report focuses on plant succession and communities, and with the watershed's fish and wildlife, their habits and habitat preferences. 84 figs., 62 tabs.

47272 **Transport and fate of river discharge on the continental shelf of the Southeastern US.** Blanton, J.O.; Atkinson, L.P. (Skidaway Institute of Oceanography, Savannah, GA). *Journal of Geophysical Research;* **88**: No. C8, 4730-4738(30 May 1984). Contract AS09-76EV00889;AS09-80EV10331;AS09-76EV00901.

The authors have analyzed 8 years of wind and salinity data from a frontal zone in a region of the inner continental shelf off the southeastern United State. The changes in low-salinity water stored in the frontal zone have been parameterized by analyzing the monthly rate of change in freshwater content. When the rate of change in freshwater content was negative, the authors interpreted this as a loss of low-salinity water from the frontal zone. When this parameter was compared with seasonally averaged alongshore wind stress, the rate of loss was independent of the alongshore wind stress magnitude until threshold of about 0.1 dyne $cm^{-2}$ was reached. Above the threshold there was a clear relationship between northward alongshore wind stress and rate of loss of freshwater from the inner shelf. Experimental evidence suggests that horizontal currents in the inner-shelf frontal zone have cyclonic shear with increasing depth. When wind stress is northward and offshore, near-shore low-salinity water is transported offshore by Ekman transport while near-bottom high-salinity water is transported shoreward.

47273 **Further analysis of respiration in a North American lake ecosystem.** Rich, P.H. (Univ. of Connecticut, Storrs). *Verhandlungen - Internationale Vereinigung fuer Theoretische und Angewandte Limnologie;* **22**: 1-7(1984). Contract AC02-76EV01599.

High respiratory quotients (RQ = DIC accumulation/DO uptake) in a marl lake-ecosystem (Lawrence Lake, MI, USA) were caused by extra DIC produced by anaerobic respiration at the bottom and an exaggeration of the proportions of anaerobic DIC by oxygenic photosynthesis in the water column during winter stratification. At Lawrence Lake the areal RQ's used to compare North American lake ecosystems by Rich and Devol (1978) were distorted by photosynthesis in the water column both summer and winter, but were not inflated by re-dissolved carbonate sediments. The fundamental RQ was a better estimate of the RQ of lake-ecosystem DIC regeneration than the areal RQ.

## 5202 Chemicals Monitoring And Transport

*REFER ALSO TO CITATION(S) 46017, 46018, 46027, 46028, 46031, 46399, 47270*

47274 **(CONF-850943—4) Application of $^{137}Cs$ and $^{210}Pb$ in tracing the fate of mercury in a river-reservoir system.** Turner, R.R.; Olsen, C.R. (Oak Ridge National Lab., TN (USA)). 1985. Contract AC05-84OR21400. 4p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85017001.

From 5. international conference on heavy metals in the environment; Athens, Greece (10 Sep 1985).

The vertical distribution of $^{137}Cs$ and $^{210}Pb$ in sediment cores from the Tennessee River-Reservoir System (USA) was used to trace the fate of Hg discharged from two upstream facilities and to resolve the relative contribution from each facility. Discharges since 1943 at the Oak Ridge nuclear facilities left a clear record of releases for Hg and $^{137}Cs$ in undisturbed downstream sediments. High releases in the 1950s are reflected in well-defined peaks, located 30 cm or more below the sediment-water interface, which can now be used to accurately date sediment layers. Chronologies based on $^{210}Pb$ gave sediment ages concordant with those based on the release histories and helped to resolve mercury contributions from a chloralkali plant located 150 km downstream of the Oak Ridge facilities.

47275 (CONF-8506155—, pp 11-13) **Research concerning indirect environmental pathways.** Riley, R.G. (Pacific Northwest Lab., Richland, WA). 1985. NTIS, PC A06/MF A01. File Number DE85016336.

From Health and environmental effects of complex chemical mixtures; Chicago, IL, USA (17 Jun 1985).

An overview is presented of the research at PNL on environmental pathways for complex mixtures which has focused on developing a basic understanding of the chemical and metabolic constraints affecting transport of complex organic mixtures in "water-fish-animal" and "soil-plant-animal" pathways.

47276 (CONF-8506155—, pp 15-16) **Approaches to forecasting the fate and effects of toxic chemicals in aquatic ecosystems.** Bartell, S.M. (Oak Ridge National Lab., TN). 1985. NTIS, PC A06/MF A01. File Number DE85016336. Contract AC05-84OR21400.

From Health and environmental effects of complex chemical mixtures; Chicago, IL, USA (17 Jun 1985).

The Fates of Aromatics Model (FOAM) was developed to forecast the transport, degradation, and accumulation of polycyclic aromatic hydrocarbons (PAHs) in aquatic ecosystems. FOAM was designed to evaluate the hypothesis that the fate of PAHs could be

predicted from fundamental chemical characteristics of individual compounds. The model simulates accumulation of PAHs by sediments, suspended particulate matter, primary producers, (macrophytes, periphyton, phytoplankton), and consumers (zooplankton, benthic invertebrates, fish). The model is currently being used to examine the accumulation of phenanthrene by sediments and biological compounds of the Hersey River, located in west central Michigan. (DT)

47277 (CONF-8506155—, pp 17-20) **Environmental, physiological, and molecular mechanisms controlling food chain transfer of organic contaminants in aquatic systems.** McCarthy, J.F.; Jimenez, B.D.; Black, M.C. (Oak Ridge National Lab., TN; Univ. of Tennessee, Knoxville). 1985. NTIS, PC A06/MF A01. File Number DE85016336.

From Health and environmental effects of complex chemical mixtures; Chicago, IL, USA (17 Jun 1985).

An holistic approach is being used to examine how factors influence the fate and bioavailability of polycyclic aromatic hydrocarbons in the aquatic environment. Research has demonstrated that the presence of naturally occurring dissolved organic matter in aquatic systems will affect the transport and fate of energy-related organic contaminants and will greatly reduce their availability for uptake by aquatic organisms and their potential for transfer to man via food chains. Bluegill sunfish, Lepomis macrochirus, were exposed to benzo(a)pyrene (BaP) to examine the effect of temperature and feeding regime on the uptake and elimination rates, extent of biotransformation, and chemical nature of the metabolites within the fish. (DT)

47278 (DOE/ER—0156/3) **Geochemical, hydrological and biological cycling of energy residuals. Research plan: subsurface transport program.** Wobber, F.J. (USDOE Office of Energy Research, Washington, DC. Ecological Research Div.). Sep 1985. 45p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85017506.

Because natural processes associated with the release and the transport of organic compounds, trace metals, and radionuclides are incompletely understood, research in this area is critical if the long term scientific uncertainties about contaminant transport are to be resolved. The processes that control mobilization and attenuation of energy residuals in soils and geological strata, their hydrological transport to and within ground water regimes, and their accumulation in biological systems require research attention. A summary of DOE's core research program is described. It is designed to provide a base of fundamental scientific information so that the geochemical hydrological, and biophysical mechanics that contribute to the transport and long term fate of energy related contaminants in natural systems can be understood.

47279 (DOE/ER/60031—T1, pp 293-310) **People and the plankton.** Eppley, R.W. [1985]. NTIS, PC A15/MF A01. File Number DE85013666.

In Research on the marine food chain. Final technical report.

The Food Chain Research Group has studied three human impacts on the local plankton. The first and largest impact is due to the effluents of the waste treatment outfalls. These effluents influence the plankton most directly by providing nutrients for phytoplankton growth. Secondly, a smaller impact was caused by an ammonium-rich effluent in Santa Monica Bay. This area of enhanced ammonium concentration was also an area of elevated phytoplankton biomass. The smallest scale impact we have identified was due to the use of chlorine as an anti-fouling agent in the cooling waters of a power plant. The oxidants that formed when chlorine reacts with seawater reduced phytoplankton photosynthesis in the waters near the cooling water outflow. 6 figs., 2 tabs.

47280 (IVL-B—752) **Diesel oil spill in a model ecosystem - seawater concentration, and bioaccumulation in two mussel species (Mytilus edulis and Macoma baltica).** Mattsson, J.; Notini, M. (Swedish Environmental Research Inst., Stockholm). Oct 1984. 22p. (In Swedish). NTIS (US Sales Only), PC A02/MF A01. File Number DE85752539.

In a 7.5 $m^3$ outdoor pool with a continuous flow of seawater and experimental spill was carried out. The pool contained the main constituents of the shallow hard bottom ecosystem of the Baltic, dominated by the bladder-wrack Fucus vesiculosus, which provides shelter and food for several species of fish, crustaceans and molluscs. 3.0 l of diesel oil was poured on the surface of the pool after which oil concentrations in the outgoing seawater was measurd by continuous extraction. The total amount of extractable organics (IR) was 0.56 mg/l during the first day after the spill. Then the oil levels in the seawater decreased continuously and two months after the spill the concentration was only 0.004 mg/l. Parallel with the water analysis, bioaccumulation in the two mussel species Mytilus edulis and Macoma baltica was investigated. Mytilus edulis, a filter-feeder living close to the water surface, showed a rapid increase of oil levels. Seven days after the spill they reached maximum levels, 10,200 μg/g dw. 25 days later their tissue burden had decreased to 3,400 μg/g. Macoma baltica showed a successive increase of oil levels during the experiment. They reached maximum levels of 4,300 μg/g dw when the bioaccumulation experiment was terminated 32 days after the spill. The difference between the two species was probably a consequency of their different living habits. Mytilus utilized the upper part of the pool system close to the oil slick, while Macoma was buried in the sediment, living on sedimentating material.

47281 (LA-UR—85-3102) **Effects of geochemical processes on the transport of contaminants in multicomponent systems: a modeling perspective.** Cederberg, G.A. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 7p. (CONF-850981—3). NTIS, PC A02/MF A01; GPO Dep. File Number DE85017525.

From International symposium on coupled processes affecting the performance of a nuclear waste repository; Berkeley, CA, USA (18 Sep 1985).

An equilibrium geochemical transport model for multicomponent systems, TRANQL, was used to investigate the effects of geochemical processes on the transport of contaminants. TRANQL was used to investigate the sensitivity of cadmium transport to a range of initial condition, pH, complexing ligand concentrations, and concentrations of a simultaneously sorbing solute. Aqueous-phase complexation, dissociation of water, and sorption were the processes considered. First, the transport of an initial pulse of cadmium with a constant concentration of EDTA was examined. Second, the transport of an initial pulse of cadmium with a constant concentration of EDTA was simulated. The effects of variations in EDTA concentrations and pH were investigated. Finally, the transport of an initial pulse of cadmium and cobalt was examined. Results show a significant coupling between the geochemical processes of complexation and sorption and mass-transport. In cases where sorption is considered to be an important controlling reaction the transport of a solute in multicomponent systems is a strong function of the initial concentration and distribution of complexing ligands, pH, equilibrium formation constants, and the concentration of a simultaneously sorbing solute. 5 refs., 8 figs., 3 tabs.

47282 (PNL-SA—13282) **Approach to uncertainty assessment for fluid flow and contaminant transport modeling in heterogeneous groundwater systems.** Nelson, R.W.; Jacobson, E.A.; Conbere, W. (Pacific Northwest Labs., Richland, WA (USA)). Jun 1985. Contract AC06-76RL01830. 24p. (CONF-850780—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85016621.

From NATO advanced study institute on fundamentals of transport phenomena in porous media; Newark, DE, USA (14 Jul 1985).

There is a growing awareness of the need to quantify uncertainty in groundwater flow and transport model results. Regulatory organizations are beginning to request the statistical distributions of predicted contaminant arrival to the biosphere, so that realistic confidence intervals can be obtained for the modeling results. To meet these needs, methods are being developed to quantify uncertainty in the subsurface flow and transport analysis sequence. A method for evaluating this uncertainty, described in this paper, considers uncertainty in material properties and was applied to an example field problem. Our analysis begins by using field measurements of transmissivity and hydraulic head in a regional, parameter estimation method to obtain a calibrated fluid flow model and a covariance matrix of the parameter estimation errors. The calibrated model and

the covariance matrix are next used in a conditional simulation mode to generate a large number of 'head realizations.' The specific pore water velocity distribution for each realization is calculated from the effective porosity, the aquifer parameter realization, and the associated head values. Each velocity distribution is used to obtain a transport solution for a contaminant originating from the same source for all realizations. The results are the statistical distributions for the outflow arrival times. The confidence intervals for contamination reaching the biosphere are obtained from the outflow statistical distributions. 20 refs., 12 figs.

47283 **(SNV-PM—1849) Acid groundwater - state-of-the-art.** Maxe, L.; Jacks, G. (Statens Natuurvaardsverk, Solna (Sweden)). Jul 1984. 50p. (In Swedish). NTIS (US Sales Only), PC A03/MF A01. File Number DE85752533.

The report is divided into four parts: - General geohydrology - Chemical and biological processes along the flowpaths of water - Environmental factors that tend to give acid ground water - Liming to improve ground water quality. Three distinct zones can be distinguished along the pathway of the water through the ground, namely the unsaturated zone, the saturated zone and the discharge zone. Acid ground water is often found in areas with podsolic soil. Weathering and cation circulation in a podsol profile is discussed and visualized. Soil acidifying processes are listed and their relative importance is discussed. Acid rain is a major acidifier on medium and poor forest soils. Levels and distribution in time and space of carbon dioxide in the soil is dealt with as a prerequisite for the formation of bicarbonate waters. The possible behaviour of aluminium and sulphur, key elements in connection with acid rain, is described. The gradual neutralization along the flowpaths of the ground water is summarized. Redox-reactions of importance for the acidity of the water are listed. Environmental factors that tend to give acid ground water are: - abundant and acid precipitation - weathering-resistant soils and rocks - coarse materials in aquifers - short turn-over time. The liming materials best suited for the neutralization of acid natural soils are powdered limestone and dolimite. Acid soils require to be neutralized to about 80% base-saturation in order to give a soil solution with a pH above 6. The required application of limestone seems to be in the order of 5 - 25 tons/ha. It may be useful to apply the material more abundantly on zones of higher infiltration like local depressions and along margins of outcrops.

47284 **(SNV-PM—1912) Research program for mercury. Occurrence and turnover of mercury in the environment.** Lindqvist, O.; Johansson, K.; Timm, B.; Hovsenius, G. (Statens Natuurvaardsverk, Solna (Sweden)). 1984. 29p. (In Swedish). NTIS (US Sales Only), PC A03/MF A01. File Number DE85752537.

In March 1984 the Research Committee at the National Swedish Environment Protection Board decided to make a concentrated research effort in the field of mercury in the environment. In a joint project with several industrial companies research is beeing planned for a period of five years, starting with the fiscal year 1984/85 and with a budget of SEK 1.2 - 1.8 million/year. The outline of the research programme is presented in this publication. The purposes are to study the occurrence of mercury in natural systems, that is, in air, precipitation, surface water and soils, and to study the fluxes between these reservoirs, and the biological and chemical transformation processes between the various chemical forms. The research is focussed on those factors which are most important for the accumulation of mercury in biota. Priorities are set so as to make the results directly useful as a basis for making predictions and for evaluating different counter measures aiming at a decrease of the mercury content in fish in Swedish lakes. This means that basic research like mechanism studies will be dealt with to a limited extent. Research will be conducted in the following fields: 1. Emissions 2. Atmospheric transport and transformation. Deposition 3. The turnover of mercury in aquatic and terrestrial systems 4. Bioaccumulation.

47285 **Nonequilibrium and equilibrium sorption with a linear sorption isotherm during mass transport through an infinite porous medium: some analytical solutions.** Carnahan, C.L.; Remei, J.S. (Lawrence Berkeley Lab., CA). *Journal of Hydrology;* **73**: No. 3-4, 227-258(Aug 1984). Contract AC03-76SF00098.

Analytical solutions have been developed for the three-dimensional axisymmetric problem of solute transport in a steady field of groundwater flow with nonequilibrium mass transfer of a radioactive species between fluid and solid phases, and with unequal longitudinal and lateral hydrodynamic dispersion. Interphase mass transfer is described by a first-order rate expression. Solutions are presented also for the case of equilibrium distribution of solute between fluid and solid phases. Three types of release from a point source were considered: instantaneous release of a finite mass of solute, continuous release at an exponentially decaying rate, and release for a finite period of time. Computational results for point-source solutions show the expected variation of sorptive retardation effects progressing from the case of no sorption, through cases of nonequilibrium sorption, to the case of equilibrium sorption. The point-source solutions are directly applicable to the development of analytical solutions of problems involving source functions occupying finite regions of the space in which transport takes place. 28 references, 1 figure.

47286 **Behavior of trace metals in Mytilus edulis during a reciprocal transplant field experiment.** Roesijadi, G.; Young, J.S.; Drum, A.S.; Gurtisen, J.M. (Battelle Pacific Northwest Labs., Sequim, WA). *Marine Ecology: Progress Series;* **18**: No. 1-2, 155-170(Jun 1984).

Marine mussels Mytilus edulis were transplanted reciprocally from relatively pristine Sequim Bay to a metal-contaminated site at Tacoma (both Washington State) and vice versa. Temporal patterns of trace metal accumulation by the mussels, metal incorporation into subcellular compartments (low molecular weight, metal-binding proteins, lysosome-like vesicles) and condition index (a measure of animal health) were studied in a field experiment. Analysis of seawater from the Tacoma site showed elevated concentrations in all the metals examined in this study; i.e. copper, zinc, cadmium, mercury, and silver. Mussels transferred from Sequim to Tacoma accumulated metals rapidly and approached or exceeded the metal concentrations in Tacoma mussels. Loss of metals following reciprocal transfer was relatively rapid in copper and silver values which were close to background levels after 4 wk and slower with zinc and mercury (24 wk or longer to background). Patterns of accumulation and loss and organs for concentration were specific for individual metals. Gills and digestive gland, for example, varied in their abilities to concentrate different metals and were often more sensitive indicators of metal bioconcentration than the whole organism. 36 references, 12 figures, 4 tables.

47287 **Desorption and coagulation of trace elements during estuarine mixing.** Li, Y.H.; Burkhardt, L.; Teraoka, H. (Lamont-Doherty Geological Observatory of Columbia Univ., Palisades, NY). *Geochimica et Cosmochimica Acta;* **48**: 1879-1884(1984). Contract AC02-76EV02185.

Mixing experiments of seawater and the Hudson and Mississippi riverwaters with radiotracer spikes show that Co, Mn, Cs, Cd, Zn and Ba will be desorbed from river suspended particles, while significant fractions of dissolved Fe, Sn, Bi, Ce and Hg will be coagulated during estuarine mixing. 25 references, 4 figures, 2 tables.

## 5203 Radioactive Materials Monitoring And Transport

*REFER ALSO TO CITATION(S) 46172, 46209, 46210, 46211, 46217, 46218, 46219, 46223, 47232, 47249, 47281, 47868*

47288 **(INIS-mf—9357) Dispersivity of an aquifer.** Naff, R.L. (Hahn-Meitner-Institut fuer Kernforschung Berlin G.m.b.H. (Germany, F.R.). Projekt Sicherheitsstudien Entsorgung (PSE)). Feb 1984. 35p. (In German). NTIS (US Sales Only), PC A03/MF A01. File Number DE85781614.

The book discusses the propagation of labelling compounds, especially in porous media, and Gelhar and Axness's analytical method on macrodispersion. To fix the statistical parameters of macrodispersion the work proposes gauging of geophysical profiles of wells according to permeability by means of γ-bore hole measurements. (DG).

47289 (INIS-mf—9758, pp vp) **Radiation in a water treatment plant with elevated radon and radium concentration in water.** Ulbak, K.; Klinder, O. (Statens Inst. for Straalehygiejne, Copenhagen (Denmark)). 1984. (In Danish). NTIS (US Sales Only), PC A08/MF A01. File Number DE85781601. (CONF-8410282—Absts.).

From 7. Nordic Society for Radiation Protection ordinary meeting; Copenhagen, Denmark (10 Oct 1984).
Published in summary form only.

47290 (INIS-mf—9758, pp vp) **Radionuclide measurement in sewage sludge from waste processing plant at Lynetten.** Ennow, K.; Hansen, A.M. (Statens Inst. for Straalehygiejne, Copenhagen (Denmark)). 1984. (In Danish). NTIS (US Sales Only), PC A08/MF A01. File Number DE85781601. (CONF-8410282—Absts.).

From 7. Nordic Society for Radiation Protection ordinary meeting; Copenhagen, Denmark (10 Oct 1984).
Published in summary form only.

47291 (INIS-mf—9758, pp vp) **Strontium-90, cesium-137, plutonium 239 and plutonium 240 inventories in the Baltic Sea.** Salo, A. (Finnish Centre for Radiation and Nuclear Safety, Helsinki). 1984. NTIS (US Sales Only), PC A08/MF A01. File Number DE85781601. (CONF-8410282—Absts.).

From 7. Nordic Society for Radiation Protection ordinary meeting; Copenhagen, Denmark (10 Oct 1984).
Published in summary form only.

47292 (INIS-mf—9758, pp vp) **Radioactivity in the sewage sludge from Scania waste processing plants.** Bjurman, B. (Lunds Lasarett (Sweden)); Erlandsson, B. (Lund Univ. (Sweden)); Mattsson, S. (Sahlgrenska Sjukhuset, Goeteborg (Sweden)). 1984. (In Swedish). NTIS (US Sales Only), PC A08/MF A01. File Number DE85781601. (CONF-8410282—Absts.).

From 7. Nordic Society for Radiation Protection ordinary meeting; Copenhagen, Denmark (10 Oct 1984).
Published in summary form only.

47293 (INIS-mf—9758, pp vp) **Cesium-137, plutonium and americium 241 in the bottom fauna of the Baltic Sea.** Agnedal, P.O. (Studsvik Energiteknik AB, Nykoeping (Sweden)). 1984. (In Swedish). NTIS (US Sales Only), PC A08/MF A01. File Number DE85781601. (CONF-8410282—Absts.).

From 7. Nordic Society for Radiation Protection ordinary meeting; Copenhagen, Denmark (10 Oct 1984).
Published in summary form only.

47294 (NUREG/CR—4251-Vol.1) **Mitigative techniques for ground-water contamination associated with severe nuclear accidents. Analysis of generic site conditions. Volume 1.** Oberlander, P.L.; Skaggs, R.L.; Shafer, J.M. (Pacific Northwest Labs., Richland, WA (USA)). Aug 1985. Contract AC06-76RL01830. 319p. (PNL—5461-Vol.1). NTIS, PC A14/MF A01 - GPO. File Number TI85017658.

The Pacific Northwest Laboratory evaluated the feasibility of using ground-water contaminant mitigation techniques to control radionuclide migration following a severe commercial nuclear power reactor accident. The two types of severe commercial reactor accidents investigated are: (1) containment basemat penetration of core melt debris which slowly cools and leaches radionuclides to the subsurface environment, and (2) containment basemat penetration of sump water without full penetration of the core mass. Six generic hydrogeologic site classifications were developed from an evaluation of reported data pertaining to the hydrogeologic properties of all existing and proposed commercial reactor sites. One-dimensional radionuclide transport analyses were conducted on each of the individual reactor sites to determine the generic characteristics of a radionuclide discharge to an accessible environment. Ground-water contaminant mitigation techniques that may be suitable, depending on specific site and accident conditions, for severe power plant accidents were identified and evaluated. Feasible mitigative techniques and associated constraints on feasibility were determined for each of the six hydrogeologic site classifications. Three case studies were conducted at power plant sites located along the Texas Gulf Coast and the Ohio River. Mitigative strategies were evaluated for their impact on contaminant transport. Results show that the techniques evaluated significantly increased ground-water travel times and reduced contaminant migration rates.

47295 (NUREG/CR—4251-Vol.2) **Mitigative techniques for groundwater contamination associated with severe nuclear accidents. Case study analysis of hydrologic characterization and mitigative schemes. Volume 2.** Oberlander, P.L.; Skaggs, R.L.; Shafer, J.M. (Pacific Northwest Labs., Richland, WA (USA)). Aug 1985. Contract AC06-76RL01830. 301p. (PNL—5461-Vol.2). NTIS, PC A14/MF A01 - GPO. File Number TI85017659.

The Pacific Northwest Laboratory evaluated the feasibility of using groundwater contaminant mitigation techniques to control radionuclide migration following a severe commercial nuclear power reactor accident. The two types of severe commercial reactor accidents investigated are: (1) containment basemat penetration of core melt debris which slowly cools and leaches radionuclides to the subsurface environment; and (2) containment basemat penetration of sump water without full penetraton of the core mass. Six generic hydrogeologic site classifications were developed from an evaluation of reported data pertaining to the hydrogeologic properties of all existing and proposed commercial reactor sites. One-dimensional radionuclide transport analyses were conducted on each of the individual reactor sites to determine the generic characteristics of a radionuclide discharge to an accessible environment. Groundwater contaminant mitigation techniques that may be suitable, depending on specific site and accident conditions, for severe power plant accidents were identified and evaluated. Feasible mitigative techniques and associated constraints on feasibility were determined for each of the six hydrogeologic site classifications. Three case studies were conducted at power plant sites located along the Texas Gulf Coast and the Ohio River. Mitigative strategies were evaluated for their impact on contaminant transport. Results show that the techniques evaluated significantly increased groundwater travel times and reduced contaminant migration rates.

47296 (USGS/WRI—84-4237) **Occurrence of natural radium-226 radioactivity in ground water of Sarasota County, Florida.** Miller, R.L.; Sutcliffe, H. Jr. (Geological Survey, Tallahassee, FL (USA)). 1985. 42p. US Geological Survey, Box 25425, Federal Center, Denver, CO 80225. File Number TI85902095.

Water that contains radium-226 radioactivity in excess of the 5.0-picocurie-per-liter limit set for radium-226 plus radium-228 in the National Interim Primary Drinking Water Regulations was obtained from the majority of wells sampled throughout Sarasota County. A comparison of data from different aquifers showed that greater radium-226 radioactivities occurred in the intermediate aquifer where phosphate pebbles occur in a semiconsolidated matrix than occurred in deeper aquifers. The highest radioactivity determined for radium-226 was 100 picocuries per liter in a saline water sample. Analysis of data suggests that a major fraction of radium-226 is released by alpha-particle recoil of thorium-230 or its precursors. Water that contains the highest concentrations of radium-226 usually contains enough water hardness or dissolved solids that it would not be used for domestic purposes without treatment. Thus, ion exchange softening to reduce hardness or reverse osmosis to reduce dissolved-solids concentrations will also reduce radium-226 radioactivities to less than the 5.0-picocurie-per-liter limit for drinking water.

## 5204 Thermal Effluents Monitoring And Transport

*REFER ALSO TO CITATION(S) 47300*

47297 (DPST—85-376) **Lower food chain community study: thermal effects and post-thermal recovery in the streams and swamps of the Savannah River Plant.** Kondratieff, P.; Kondratieff, B.C. (Environmental and Chemical Sciences, Inc., Aiken, SC (USA)). Jul 1985. Contract AC09-76SR00001. 126p. (ECS-SR—85-376). NTIS, PC A07/MF A01; GPO Dep. File Number DE85017701.

The effects of thermal stress on lower food chain communities of streams and swamps of the Savannah River Plant. Both the autotroph assemblages and the macro invertebrate communities were studied in streams receiving heated reactor effluent. To document stream and swamp ecosystem recovery from thermal stress, the same communities of organisms were studied in a stream/swamp ecosystem which had received heated reactor effluent in the past. (ACR)

### 5205 Site Resource And Use Studies

*REFER ALSO TO CITATION(S) 46181, 46269, 47258*

47298 **(DOE/BP/11797—2) Migrational characteristics of Columbia Basin salmon and steelhead trout, 1984. Part II. Smolt Monitoring Program. 1984 Annual report.** McConnaha, W.E.; Basham, L.R.; Jordan, J. (Water Budget Center, Portland, OR (USA)). Jul 1985. Contract AC79-84BP11797. 174p. NTIS, PC A08/MF A01; 1; GPO Dep. File Number DE85017331.

The report describes the travel time of marked yearling and sub-yearling chinook salmon (Oncorhynchus tshawytscha), sockeye salmon (O. nerka), and steelhead trout (Salmo gairdneri) between points within the system, and reports the arrival timing and duration of the migrations for these species as well as coho salmon (O. kisutch). A final listing of 1984 hatchery releases is also included. 8 refs., 26 figs., 20 tabs.

47299 **(DOE/BP/35097—2) Abundance and distribution of walleye, northern squawfish and smallmouth bass in John Day Reservoir, 1984. Annual progress report.** Nigro, A.A.; Beamesderfer, R.C.; Elliott, J.C.; Faler, M.P.; Miller, L.M.; Uremovich, B.L. (Oregon Dept. of Fish and Wildlife, Portland (USA). Columbia River Section). Jun 1985. Contract AI79-82BP35097. 124p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE85016236.

Walleye, northern squawfish and smallmouth bass abundances were estimated in John Day Reservoir using a modified Schnabel multiple mark and recapture estimator. Sampling was conducted from March 25 to August 31 using gill nets, trap nets, boat electrofishing, angling and an angler survey. A total of 858 walleye, 4552 northern squawfish, and 1599 smallmouth bass were collected. Discrete populations were defined according to observed movements of recaptured and radiotagged fish. Abundance estimates were corrected for angler harvest, size selectivity of gear, tag loss and recruitment due to growth during sampling. In addition, the likelihood of biases resulting from differential mortality of marked fish was examined. Abundances in John Day pool of walleye and northern squawfish with fork lengths greater than 250 mm were estimated at 15,832 and 80,486. Abundances of smallmouth bass with fork lengths greater than 200 mm were estimated to be 2596 in lower John Day pool and 1791 in upper John Day pool. Walleye and northern squawfish moved throughout the pool, whereas movements by smallmouth bass were more localized. Angler harvests of walleye and smallmouth bass in upper John Day pool from April through August were estimated at 309 and 584 fish. Angler harvest of northern squawfish was negligible. Most walleye collected were age 5. The most abundant age groups of northern squawfish and smallmouth bass were 10 and 2. 10 refs., 28 figs., 12 tabs.

47300 **(DPST—85-377) Savannah River Aquatic Ecology Program. Volume II. Ichthyoplankton. Annual report, September 1983-August 1984.** Paller, M.; O'Hara, J.; Osteen, D.V. (Environmental and Chemical Sciences, Inc., Aiken, SC (USA)). May 1985. Contract AC09-76SR00001. 186p. (ECS-SR—18). NTIS, PC A09/MF A01; 1; GPO Dep. File Number DE85017702.

This report presents the results of the 1984 Savannah River ichthyoplankton monitoring program. The objectives were: (1) to determine the density and distribution of ichthyoplankton at designated locations in the Savannah River, tributaries and intake canals of the SRP between the New Savannah Bluff Lock and Dam (RM 187.1), and the area of tidal influence near Port Wentworth, Georgia (RM 29.6); (2) to evaluate the river and creeks upstream, adjacent to and downstream of the SRP for their relative contribution to the ichthyoplankton community of the Savannah River system; (3) to provide data to evaluate the impact of the present and proposed cooling water intake rates on fish eggs and larvae; (4) to provide data to evaluate the impact of existing and proposed thermal discharges to the river; and (5) to provide information on the magnitude of yearly variations in ichthyoplankton density and abundance in the mid- and lower reaches of the Savannah River and its tributaries.

### 5206 Regulations

*REFER ALSO TO CITATION(S) 46214*

47301 **Biomonitoring for toxics control in NPDES permitting.** Roop, R.D.; Hunsaker, C.T. (Oak Ridge National Lab., TN). *Journal - Water Pollution Control Federation;* **57**: No. 4, 271-276(Apr 1985).

To explore the uses of biological monitoring in control and regulation of toxic wastewaters, the Water Pollution Control Federation Ecology Committee sponsored a workshop at the New Orleans Annual Meeting. This article summarizes the major topics that were discussed: overview of monitoring; rationale for using biomonitoring in permitting; EPA's assessment methodology; and issues in the water quality-based toxics control process.

## 53 ENVIRONMENTAL-SOCIAL ASPECTS OF ENERGY TECHNOLOGIES

### 5301 Social And Economic Studies

*REFER ALSO TO CITATION(S) 47431*

### 5302 Assessment Of Energy Technologies

*REFER ALSO TO CITATION(S) 46213, 47431*

47302 **(SNV-PM—1833) Heat extraction from ground, water and air. Positive environmental effects when realized in a right way.** Dietrichson, W.; Carlsson, S.Aa.; Kvarnaes, H. (Statens Natuurvaardsverk, Solna (Sweden)). Jun 1984. 55p. (In Swedish). NTIS (US Sales Only), PC A04/MF A01. File Number DE85752528.

This report deals with heat from ground sources, ground water, rocks, surface water, waste water and air. Appropriate techniques are described and the environmental impacts are discussed. Suitable rules and examinations are represented and procedures to reduce negative environmental effects are recommended. The need for the appraisement of environmental impact when extracting heat from lake water is presented.

## 55 BIOMEDICAL SCIENCES, BASIC STUDIES

### 5502 Biochemistry

*REFER ALSO TO CITATION(S) 46859, 47328*

47303 (INIS-mf—9742, pp 253-257) **$^3$H-cystine incorporation into brain microvessels of Rana Quantitative equidensitometric measurements in autoradiographs.** Hess, J.; Vullings, H.G.B. (Karl-Marx-Universitaet, Leipzig (German Democratic Republic). Sektion Biowissenschaften); Diederen, J.H.B. (Rijksuniversiteit Utrecht (Netherlands). Zoologisch Lab.). 1983. NTIS (US Sales Only), PC A12/MF A01. File Number DE85781598. (CONF-8305206—).

From 13. international symposium on autoradiography; Tabor, Czechoslovakia (2 May 1983).

After $^3$H-cystine application to three forms of European green frogs, Rana lessonae, Rana ridibunda, and their hybrid, Rana

esculenta, a pronounced labelling of brain microvessels was observed in the corresponding autoradiographs. This labelling was quantitatively estimated using image analysing system Densitron and is supposed to result from an incorporation of the labelled amino acid into endothelial cells followed by a deposit of newly synthesized material including collagenous proteins of the basal lamina. (author).

47304 **Molecular mechanisms of visual excitation: A concatenation of nonlinear cellular processes.** Bitensky, M.W.; George, J.S.; Whalen, M.; Yamazaki, A. (Life Sciences Division, Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Journal of Statistical Physics;* **39**: No. 3, 513-550(Jun 1985).

The mechanism of transduction in the photoreceptor remains the least understood link in the chain of molecular and cellular processes that are responsible for vision. This paper reviews the molecular species and processes involved in the absorption of light and subsequent biochemical responses of the photoreceptor cell. The cells' electrical response and the probable ionic basis of the response are described. We develop the outlines of a mechanistic model that attempts to link biochemical and electrophysiological responses of photoreceptors of the vertebrate retina.

## 5503 Cytology

*REFER ALSO TO CITATION(S) 47400*

## 5504 Genetics

*REFER ALSO TO CITATION(S) 47329*

47305 **Chromosomal abnormalities in human sperm: comparisons among four healthy men.** Brandriff, B.; Gordon, L.; Ashworth, L.; Watchmaker, G.; Carrano, A.; Wyrobek, A. (Lawrence Livermore National Lab., CA). *Human Genetics;* **66**: 193-201(1984). Contract W-7405-ENG-48.

The human-sperm/hamster-egg system has been used to compare the frequencies of structural and numerical chromosomal aberrations in 909 sperm karyotypes from four normal healthy men. The frequency of structural aberrations was 1.3, 4.8, 9.0, and 10.4% respectively in the four donors. Certain specific breakpoints were seen twice or even three times in three of the donors. The incidence of aneuploidy was 1.3, 1.4, 1.4, and 1.9%. In three donors the frequencies of structural aberrations were significantly higher in sperm than in lymphocytes from the same man. X-to-Y ratios did not differ significantly from the expected 50:50. 37 references, 4 figures, 5 tables.

## 5505 Metabolism

*REFER ALSO TO CITATION(S) 46309, 47277, 47422, 47424*

47306 **Light-induced proton gradients and internal volumes in chromatophores of Rhodopseudomonas sphaeroides.** Melandri, B.A.; Mehlhorn, R.J.; Packer, L. (Univ. of Bologna, Italy). *Archives of Biochemistry and Biophysics;* **235**: No. 1, 97-105(15 Nov 1984).

To test the predictions of the chemiosmotic hypothesis, it is essential to have sensitive and accurate measures of the aqueous volume and pH within membrane compartments. One unique feature of the present investigation is the application of electron spin resonance probes to determine internal aqueous volume and pH changes in bacterial chromatophores under virtually identical conditions. Volumes of the chromatophores ranged from 6 to 16 μl/mg bacteriochlorophyll among different preparations, and were sensitive to the osmolarity of the suspending buffer. pH gradients reached two units in illuminated chromatophores as determined with ESR methods, and increased when KCl and valinomycin were added to the assay. Measurements with the fluorescent dye 9-amino-acridine yielded similar pH gradients, provided that an operational vesicle volume, which corrected for the binding of the dye to the membrane, was used in the calculation. The sensitivity of the ESR method allowed the measurement of pH gradients resulting from only a few light flashes. A plot of pH gradients versus number of flashes was linear up to about 30 flashes, and intercepted the origin. This result is consistent with proton release into the bulk aqueous phase after only a single light flash. This ability to measure small pH gradients offers new opportunities for the study of energy-transducing mechanisms. 21 references, 5 figures.

## 5506 Medicine

*REFER ALSO TO CITATION(S) 46997, 47064, 47131, 47336, 47361, 47515*

47307 **(AD-A—154634/0/XAB) Beam modification for cancer radiation therapy. Master's thesis.** Keller, J.M. (Air Force Inst. of Tech., Wright-Patterson AFB, OH (USA). School of Engineering). Mar 1985. 97p. NTIS, PC A05/MF A01.

A method for designing radiation-therapy beam modifiers is proposed in this thesis. The design is based on a calculated dose distribution in the patient from an unmodified treatment beam. The modifier alters the beam before it reaches the patient in a way that yields the desired dose profile at the tumor while minimizing the dose to healthy tissues. The design can be generalized to include any modifier material and any beam energy. The design was applied to an anthropomorphic phantom and verified using thermoluminescent dosimetry. The modifier was constructed of 1/2-inch-square aluminum blocks. The dose distribution in the phantom, with and without beam modification, was measured. The modified dose profile approaches the desired distribution (maximum deviation of + or - 5%). Procedures for improving the results are suggested for further work.

47308 **(BNL—36841) Clearance of Tc-99m DTPA aerosol from coal miners' lungs.** Susskind, H.; Brill, A.B.; Harold, W.H. (Brookhaven National Lab., Upton, NY (USA)). Jul 1985. Contract AC02-76CH00016. 19p. (CONF-8509138—2). NTIS, PC A02/MF A01; GPO Dep. File Number DE85017514.

From 6. international symposium on inhaled particles; Cambridge, MA, USA (1 Sep 1985).

Alterations in regional epithelial permeability were assessed in 22 retired West Virginia coal miners' lungs by measuring the clearance of inhaled 0.5-μm Tc-99m DTPA aerosol. Activity was measured in both lungs and in regions of interest placed over the lung periphery in the apical, middle, and basal portions of each lung. Clearance rates (T/sub 1/2/) for 5 nonsmokers, 8 ex-smokers, and 9 smokers were significantly faster than for comparable subjects measured elsewhere, who were not coal miners. Regional apex-to-base distributions of DTPA were measured as a function of clearance time and compared with regional ventilation and perfusion. Regional, as well as overall lung clearance curves of 8 smokers and 4 ex-smokers had two components, with overall T/sub 1/2/ of $<7$ min for the faster one. No correlations were found between T/sub 1/2/ and DLCO or with $P(A\text{-}a)O_2$. The results of our study suggest that measurement of DTPA clearance is a potentially useful noninvasive technique to assess lung injury in miners exposed to coal dust. 14 refs., 6 figs., 2 tabs.

47309 **(BNL—36886) Positron-emitting radioligands for imaging neuroleptic receptors.** Arnett, C.D.; Fowler, J.S.; Wolf, A.P.; Shiue, C.Y.; Logan, J. (Brookhaven National Lab., Upton, NY (USA)). 1985. Contract AC02-76CH00016. 2p. (CONF-8506187—1). NTIS, PC A02. File Number DE85017516.

From 12. international symposium on cerebral blood flow and metabolism; Lund, Sweden (16 Jun 1985).

A series of $^{18}$F-labeled butyrophenones (benperidol, haloperidol, spiroperidol and N-methylspiroperidol) were evaluated in baboons and rats with respect to potential utility as radioligands for studying neuroleptic receptors in the living human brain by positron emission tomography. These compounds were administered to baboons, and the radioactivity distributions to the striatum, and to the cerebellum were determined by PET at times up to 8 hours after isotope injection. 4 refs. (DT)

47310 (CONF-791122—Absts., pp 48) **Simplification of some mathematical processes used in radiation medicine.** Niguidula, L.N. 1979. NTIS (US Sales Only), PC A04/MF A01. File Number DE82904129. (INIS-mf—9485).

From 2. Asian regional congress on radiation protection; Manila, Philippines (5 Nov 1979).
Published in abstract form only.

47311 (CONF-791122—Absts., pp 22) **Survey of radioisotope teletherapy units in the Philippines.** Sope, R.A. (Ministry of Health, Radiation Health Office, Manila (Philippines)). 1979. NTIS (US Sales Only), PC A04/MF A01. File Number DE82904129. (INIS-mf—9485).

From 2. Asian regional congress on radiation protection; Manila, Philippines (5 Nov 1979).
Published in abstract form only.

47312 (DOE/EV/10651—T1) **Radiopharmacokinetics: utilization of nuclear medicine techniques in the non-invasive study of drug distribution. Progress report.** Wolf, W. (California Univ., Los Angeles (USA)). 29 Feb 1984. Contract AT03-81EV10651. 64p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85017600.

These studies provide a basic framework in which the radiopharmokinetic models described in this report may be tested experimentally. Volume calibration factors, corrections for overlying and underlying activity, and estimates of the amount of noise in quantitative projection and tomographic images have been developed, with emphasis on particular compartments within a rat-size phantom. Studies have also been performed with live rats and the results interpreted with the aid of the physical studies described above. We expect that similar types of analyses and calibrations will be necessary in the upcoming clinical studies. 32 refs., 24 figs., 12 tabs.

47313 (INIS-mf—9343) **Dose increments in ionizing radiation therapy in tissues immediately adjacent to metallic dental prostheses.** Leischner, U. (Muenchen Univ. (Germany, F.R.). Fakultaet fuer Medizin). 6 Oct 1983. 57p. (In German). NTIS (US Sales Only), PC A04/MF A01. File Number DE85781609.

Radiation therapy in the area of the jaws and face may have harmful side effects on the tissues next to metallic dental prostheses because they increase the radiation dose. Different kinds of radiation were investigated (x-rays, gamma radiation, electron radiation and ultra-hard x-rays) and measurements carried through on different materials used in dentistry. To determine the radiation dose increment different dosimetric methods were used and compared with each other. With the aid of thin-layer beryllium oxide dosemeters it is possible to determine dose increments in the tissue directly at the surface of the material causing the dose increase. As compared to earlier publications the doses established in the adjacent layers are partly substantially higher. Tissue/gold irradiated with cobalt 60 increases the dose by a factor 2.2, if irradiated with 100 KV x-rays by a factor 58. A reduction of the dose is possible by insulation of the surrounding tissue from the metal using a different material. Plastics of the kind used for moulding in dentistry are an appropriate choice. However where the edges of dental crowns are embedded in the gingiva or pontic elements have contact to it, plastics of the necessary material thickness cannot be applied. The metallic prostheses should then be removed. (orig./HP).

47314 (INIS-mf—9344) **Investigations in the scintiscanning of joints of animals with experimental and rheumatoid arthritis.** Hanheide, M. (Giessen Univ. (Germany, F.R.). Fachbereich Humanmedizin). 1982. 125p. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE85781608.

In 69 guinea pigs with experimental hyperergic arthritis scintiscanning was done to study the course of the inflammation and the deposition of the radionuclides used. During the first days there was an added storage in the inflamed joints of those animals on whom scintiscanning with Tc99m04 had been performed. The accumulation of Tc99m04 in the joints was due to its uptake by synovial tissue and hydrarthrosis as shown by scintiscanning after haemorrhage and perfusion, macroscopic autoradiography and measurements of radioactivity in tissue samples. In 13 animals with rheumatoid arthritis scintiscanning was done twice with Tc99m04 and three times with Tc99mMDP over a period of 13 to 21 months; concomitantly laboratory tests and X-rays were conducted. After Tc99m04 there was a fall in the scintigraphic inflammation index during treatment. That index was determined by forming the quotient from the activities established above the proximal interphalangeal joints and the tibial head. Scintiscanning with Tc99mMDP led to a fall of the inflammation index in animals with classical rheumatoid arthritis, whereas in the ones with probable rheumatoid arthritis it again rose after an initial fall. Unlike x-ray investigation, scintiscanning permits an early diagnosis and course control. (orig.).

47315 (INIS-mf—9652, pp 65) **Design of a special collimator for measuring local blood flow in the brain.** Muzik, O.; Aiginger, H. (Atominstitut der Oesterreichischen Universitaeten, Vienna); Kallinger, W.; Ogris, E. (Krankenhaus der Stadt Wien-Lainz (Austria). Ludwig Boltzmann Inst. fuer Klinische Onkologie). 1984. (In German). NTIS (US Sales Only), PC A07/MF A01. File Number DE85781476. (CONF-8409235—Summ.).

From Annual meeting of the Austrian Physical Society; Leoben, Austria (24 Sep 1984).
Published in summary form only.

47316 (INIS-mf—9652, pp 66) **Dosimetry at medically used HF electron linear accelerators with upper energy 25 MeV.** Leitner, H.; Krispel, F. (Graz Univ. (Austria). Radiologische Klinik). 1984. (In German). NTIS (US Sales Only), PC A07/MF A01. File Number DE85781476. (CONF-8409235—Summ.).

From Annual meeting of the Austrian Physical Society; Leoben, Austria (24 Sep 1984).
Published in summary form only.

47317 (INIS-mf—9742, pp 235-237) **Problems of quantitative evaluation of in-vitro autoradiograms.** Theuring, F. (Medizinische Akademie, Magdeburg (German Democratic Republic)). 1983. (In German). NTIS (US Sales Only), PC A12/MF A01. File Number DE85781598. (CONF-8305206—).

From 13. international symposium on autoradiography; Tabor, Czechoslovakia (2 May 1983).
Published in summary form only.

47318 (INIS-mf—9758, pp vp) **Use of Thorotrast in Denmark and its consequences.** Faber, M. 1984. (In Danish). NTIS (US Sales Only), PC A08/MF A01. File Number DE85781601. (CONF-8410282—Absts.).

From 7. Nordic Society for Radiation Protection ordinary meeting; Copenhagen, Denmark (10 Oct 1984).
Published in summary form only.

47319 (INIS-mf—9758, pp vp) **Radiological protection optimization of procedures for manual gynaecological radiotherapy.** Jessen, K.A. (Kommunehospitalet, Aarhus (Denmark)). 1984. NTIS (US Sales Only), PC A08/MF A01. File Number DE85781601. (CONF-8410282—Absts.).

From 7. Nordic Society for Radiation Protection ordinary meeting; Copenhagen, Denmark (10 Oct 1984).
Published in summary form only.

47320 (INIS-mf—9758, pp vp) **Reduction of radiation dose in the body under panoramic tomography.** Aagaard, A. (Koebenhavns Tandlaegehoejskole, Denmark). 1984. (In Danish). NTIS (US Sales Only), PC A08/MF A01. File Number DE85781601. (CONF-8410282—Absts.).

From 7. Nordic Society for Radiation Protection ordinary meeting; Copenhagen, Denmark (10 Oct 1984).
Published in summary form only.

47321 (INIS-mf—9758, pp vp) **Patient doses and image quality in mammography.** Berg, O. (Statens Inst. for Straalehygiejne, Copenhagen (Denmark)). 1984. (In Danish). NTIS (US Sales Only), PC A08/MF A01. File Number DE85781601. (CONF-8410282—Absts.).

From 7. Nordic Society for Radiation Protection ordinary meeting; Copenhagen, Denmark (10 Oct 1984).
Published in summary form only.

47322 **(UCRL—92271-Rev.1) Radiation interactions for tomography. Revision 1.** Zolnay, A.S. (Lawrence Livermore National Lab., CA (USA)). 20 May 1985. Contract W-7405-ENG-48. 13p. (CONF-8503121—1-Rev.1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85013792.

From American Society of Nondestructive Testing spring conference; Washington, DC, USA (11 Mar 1985).

There are new requirements emerging in the field of tomography: the need for spatial resolution in the micrometre range, atomic species specificity, and quantitative density discrimination.

47323 **Pharmacokinetics of an indium-111-labeled monoclonal antibody in cancer patients.** Hnatowich, D.J.; Griffin, T.W.; Kosciuczyk, C.; Rusckowski, M.; Childs, R.L.; Mattis, J.A.; Shealy, D.; Doherty, P.W. (Univ. of Massachusetss Medical Center, Worcester). *Journal of Nuclear Medicine;* **26**: No. 8, 849-858(Aug 1985). Contract AC02-83ER60175.

The authors have evaluated the pharmacokinetics in patients of a monoclonal antibody (19-9) $F(ab')_2$ fragment coupled with DTPA and labeled with $^{111}In$. In addition to imaging and organ uptake determinations, serum and urine samples were analyzed to help determine the in vivo behavior of the label. Using a competitive binding assay, the immunoreactivity of the coupled fragment was found to be indistinguishable from that of the unmodified fragment. By a variety of techniques, they show that the only significant source of label instability was transcomplexation to circulating transferrin. Whole-body clearance of the label was slow and may be attributed entirely to urinary excretion. Organ accumulation was greatest in the liver and persisted after rapidly attaining high values. A total of 14 cancer patients were studied, nine with identifiable sites of metastatic disease from colorectal, pancreatic, ovarian, or small cell lung primaries. Eight of the 12 sites of documented tumor were visualized by external imaging (67%) most distinctly at 48-72 hr postadministration.

47324 **Precision, high dose radiotherapy. II. Helium ion treatment of tumors adjacent to critical central nervous system structures.** Saunders, W.M.; Chen, G.T.Y.; Austin-Seymour, M.; Castro, J.R.; Collier, J.M.; Gauger, G.; Gutin, P.; Phillips, T.L.; Pitluck, S.; Walton, R.E. (Univ. of California, San Francisco). *International Journal of Radiation Oncology, Biology and Physics;* **11**: No. 7, 1339-1347(Jul 1985). Contract AC03-76SF00098.

In this paper, the authors present a technique for treating relatively small, low grade tumors located very close to critical, radiation sensitive central nervous system structures such as the spinal cord and the brain stem. A beam of helium ions is used to irradiate the tumor. The nearby normal tissues are protected by exploiting the superb dose localization properties of this beam, particularly its well defined and controllable range in tissue, the increased dose deposited near the end of this range (i.e., the Bragg peak), the sharp decrease in dose beyond the Bragg peak, and the sharp penumbra of the beam. To illustrate the technique, the authors present a group of 19 patients treated for chordomas, meningiomas and low grade chondrosarcomas in the base of the skull or spinal column. They have been able to deliver high, uniform doses to the target volumes, while keeping the doses to the nearby critical tissues below the threshold for radiation damage. Follow-up on this group of patients is short, averaging 22 months (2 to 75 months). Currently, 15 patients have local control of their tumor. Two major complications, a spinal cord transsection and optic tract damage, are discussed in detail. Their treatment policies have been modified to minimize the risk of these complications in the future, and they are continuing to use this method to treat such patients.

47325 **Electrosurgical device for both mechanical cutting and coagulation of bleeding.** Doss, J.D.; McCabe, C.W. (to Dept. of Energy). US Patent Application 6-699,888. 8 Feb 1985. 14p. Contract W-7405-ENG-36. DE85017788 NTIS, PC A02/MF A01; GPO Dep. File Number DE85017788.

Bipolar electrical coagulation of tissue using radiofrequency energy is combined with the functions of conventional surgical pressure tissue cutting instruments without significant modification thereof in a single instrument with the result that a surgeon can perform both procedures without having to redirect his attention from the area of the surgery. 4 figs.

47326 **PET tomography in studies of distribution of 7.6-min potassium 38 in the dog heart.** Myers, W.G.; Bigler, R.E.; Graham, M.C. (Cornell Univ., New York, NY). *European Journal of Nuclear Medicine;* **9**: No. 6, 272-277(1984). (CONF-7910327—). Contract AC02-77EV04268.

From 21. annual meeting of the American Society of Therapeutic Radiologists; New Orleans, LA, USA (24 Oct 1979).

Potassium 38 emits a 2.68-MeV (max) positron followed promptly by a 2.17-MeV $\gamma$-ray in 99.8% of its disintegrations. A positron is emitted also, followed by a 3.94-MeV $\gamma$-ray, in 0.2% of the decays. The pairs of 511-keV PET $+/-\gamma$-quanta, which are emitted at 180 +/- 0.3° to each other, are in true coincidence with the prompt $\gamma$-rays emitted by the daughter nucleus, within the resolving time of PET instrumentation. Studies made with phantoms by means of a commercial version of the MGH PET camera demonstrated that quantitatively satisfactory images are derived, despite the presence of the prompt $\gamma$-rays. Two-dimensional (2-D) focal-plane images reveal high uptake of $^{38}K$ promptly in the myocardium of dogs, under barbiturate sedation. Third-dimensional (3-D) transverse section PET tomographic images, through four 1.0-cm thick heart slices orthogonal to the plane of the 2-D images and with 1.4-cm sequential spacing, show $^{38}K$ uptake to be concentrated especially highly in the left ventricle, as expected. Peak levels of activity were observed over the myocardium at 12 s after intravenous bolus injection of ionic $^{38}K$. Dynamic mode 2-D images were taken at intervals as short as 0.5 s and extending to 1 h.

47327 **Improved monoclonal antibodies to halodeoxyuridine.** Vanderlaan, M.; Dolbeare, F.A.; Gray, J.W.; Thomas, C.B. (to Dept. of Energy). US Patent Application 6-542,967. 18 Oct 1983. 33p. Contract W-7405-ENG-48. DE85017764 NTIS, PC A03/MF A01; GPO Dep. File Number DE85017764.

The development, method of production, characterization and methods of use of two hybridomas, CIdU-1 (ATCC Accession No. HB-8321) and CIdU-2 (ATCC Accession No. HB-8320), are described. These secrete $IgG_1(K)$ immunoglobulins that react with halodeoxyuridine (HdU or halodU) such as bromo, chloro, fluoro and iodo deoxyuridine (BrdU, CldU, FdU and IdU), whether these are free in solution or incorporated into single stranded DNA in whole cells. The antibodies do not react with naturally occurring free nucleic acids or with deoxyribonucleic acid (DNA) or ribonucleic acid (RNA) polymers. These antibodies are suitable for use in enzyme immunoassays for free CldU, FdU, IdU and BrdU and for detecting cells with these nucleotides incorporated into them. The monoclonal antibodies are useful in the detection of the sensitivity of tumor cells to specific chemotherapeutic agents, in the measurement of the rate of cellular DNA synthesis, in the measurement of the rate of proliferation of normal and malignant cells and in the detection of HPRT deficiency in cells. 1 tab.

## 5507 Microbiology

*REFER ALSO TO CITATION(S) 46026*

47328 **(DOE/BP/16479—1) Evaluation of a subunit vaccine to infectious hematopoietic necrosis (IHN) virus. Annual report FY 1984.** Leong, J.A.C. (Oregon State Univ., Corvallis (USA). Dept. of Microbiology). Jul 1985. Contract AI79-84BP16479. 53p. NTIS, PC A04/MF A01; 1; GPO Dep. File Number DE85017377.

A prototype subunit vaccine to infectious hematopoietic necrosis (IHN) virus is being developed by recombinant DNA techniques. The techniques involve the isolation and characterization of the glycoprotein gene, which encodes the viral protein responsible for inducing a protective immune response in fish. The viral glycoprotein gene has been cloned and a restriction map of the cloned gene has been prepared. Preliminary DNA sequence analysis of the cloned gene has been initiated so that manipulation of the gene for maximum expression in appropriate plasmid vectors is possible. A

recombinant plasmid containing the viral gene inserted in the proper orientation adjacent to a very strong lambda promoter and ribosome binding site has been constructed. Evaluation of this recombinant plasmid for gene expression is being conducted. Immunization trials with purified viral glycoprotein indicate that fish are protected against lethal doses of IHNV after immersion and intraperitoneal methods of immunization. In addition, cross protection immunization trials indicate that Type 2 and Type 1 IHN virus produce glycoproteins that are cross-protective. 13 figs., 5 tabs.

## 5508 Morphology

*REFER ALSO TO CITATION(S) 47329*

## 5509 Pathology

*REFER ALSO TO CITATION(S) 47327, 47413*

47329 **(DOE/EV/10360—4) Correlation of chromosome patterns in human leukemic cells with exposure to chemicals and/or radiation. Comprehensive progress report, January 1, 1983-December 31, 1985.** Rowley, J.D. (Chicago Univ., IL (USA)). Aug 1985. Contract AC02-80EV10360. 20p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85017124.

A number of chromosomal abnormalities have been found to occur with significantly regularity in several leukemias. This report describes the chromosomal location of some of these abnormalities, and the possible cellular consequences of these mutations. Specifically evidence is presented that the breakpoint junction on the short arm of No. 9 in the t(9;11) in acute monocytic leukemia lies between the alpha interferon gene normally on No. 9 and an oncogene, c-ets1, on No. 11. In the t(8;21) in acute myeloblastic leukemia, the breakpoint junction on the long arm of No. 8 is between two oncogenes, c-mos on No. 8 and c-ets2 on No. 21 which is translocated to No. 8. With the use of DNA probes and in situ chromosome hybridization, it was shown that two genes related to hematopoietic cell proliferation and differentiation are located in or near to the critical region for No. 5. Thus, granulocytic-macrophage colony stimulating factor is localized to 5q23 to 5q32 and the receptor for macrophage colony stimulating factor is localized to 5q31 to 5q33. The former gene is within the deleted region in all three patients, and the latter in two of three patients whose bone marrow cells have a deletion of No. 5. 19 refs., 3 figs.

## 5520 Public Health

47330 **(INIS-mf—9758, pp vp) Lifetime, money and cost-benefit analysis.** Bengtsson, G. 1984. NTIS (US Sales Only), PC A08/MF A01. File Number DE85781601. (CONF-8410282—Absts.).

From 7. Nordic Society for Radiation Protection ordinary meeting; Copenhagen, Denmark (10 Oct 1984).

The paper describes briefly many methods for explicit or implicit valuation of the loss of lifetime expectancy due to radiation exposures or other hazards. The health gain from investment in protection is compared with the health gain from a general increase in wealth. It is concluded that in many instances lifetime is valued at 1 to 10 times the gross national product produced in this time. This seems to be reasonable for rich countries whereas it may be questionable for poorer countries. Here, any investment that raises the level of living of the poorer segment of the population may have a greater effect on life expectancy. (author).

## 5530 Agriculture And Food Technology

47331 **(DOE/BP/13084—1) Pen rearing and imprinting of fall chinook salmon. Annual report 1984.** Novotny, J.F.; Macy, T.L.; Gardenier, J.T. (Fish and Wildlife Service, Seattle, WA (USA). Seattle National Fishery Research Center; Fish and Wildlife Service, Vancouver, WA (USA). Vancouver Fishery Assistance Office). Aug 1985. Contract AI79-83BP13084. 66p. NTIS, PC A04/MF A01; GPO Dep. File Number DE85017462.

Backwaters and ponds along the Columbia River upstream of production hatcheries may provide opportunities for creating low cost rearing facilities and additional space to accommodate hatchery thinning releases. Upriver bright, age-0 fall chinook salmon (Onchorynchus tshawaytsha) were transferred from Spring Creek National Fish Hatchery in mid-April to rearing sites located 62 and 125 miles upstream from the hatchery and reared in netted enclosures for 6-8 weeks prior to release. All fish reared at the off-station sites displayed increased growth rates and accelerated smoltification rates when compared to fish held in the hatchery. Highest rates were for fish reared in net pens at low densities and full feeding rations but more fish per unit volume were obtained when reared at higher density and a full feeding ration. Increased mortalities were associated with an outbreak of enteric redmouth disease (Yersinia ruckeri) when temperature exceeded 16 C, especially for fish reared at high density. Density of unfed fish stocked in a barrier net and net pens was low in relation to those of fed fish, but the natural food available was adequate for growth in excess of that observed in the hatchery. Mortality was relatively high (30%) in the barrier net, less than 1% for unfed fish in pens, and ranged from about 1% to 16% for fed fish in pens. 21 refs., 8 figs., 11 tabs.

47332 **(IAEA-TECDOC—325) Role of isotopes in studies on nitrogen fixation and nitrogen cycling by blue-green algae and the Azolla-Anabaena azollae association. Proceedings of a consultants meeting organized by the Joint FAO/IAEA Division of Isotope and Radiation Applications of Atomic Energy for Food and Agricultural Development and held in Vienna, 11-15 October 1982.** (Joint FAO/IAEA Div. of Isotope and Radiation Applications of Atomic Energy for Food and Agricultural Development, Vienna (Austria)). Feb 1985. 165p. (CONF-8210336—). NTIS (US Sales Only), PC A08/MF A01. File Number DE85781628.

From Consultants meeting on the role of isotopes in studies on nitrogen fixation and nitrogen cycling by blue-green algae and their associations; Vienna, Austria (11 Oct 1982).

Separate abstracts have been prepared for papers from the proceedings of a consultants meeting organized by the Joint FAO/IAEA Division of Isotope and Radiation Applications of Atomic Energy for Food and Agricultural Development. The meeting was held in Vienna, 11-15 October, 1982.

47333 **(RISO-M—2458) Nitrogen supply of crops by biological nitrogen fixation. 3. Intercropping of pea and barley.** Jensen, E.S.; Haahr, V.; Thomsen, J.D.; Sandfaer, J. (Risoe National Lab., Roskilde (Denmark)). May 1985. 139p. (In Danish). NTIS (US Sales Only), PC A07/MF A01. File Number DE85752648.

Intercropping of pea and barley was studied in field experiments during 1980-82. The utilization of fertilizer, soil and symbiotically fixed N was studied in mixtures and pure stands by means of $^{15}N$ fertilizer dilution. Soil and fertilizer N-sources was utilized with the same efficiency in mixtures and pure stand barley. The proportion of total N in pea derived from $N_2$ fixation was higher in mixtures than in pure stand. Utilization of growth factors and the advantage from intercropping, evaluated by means of the Land Equivalent Ratio (LER), was improved (LER $>$ 1) with an increasing proportion of peas in the mixture; N fertilization reduced the LER-values indicating that the improved utilization of growth factors was mainly due a better utilization of N-sources. Planting pattern of pea and barley in intercrops did not considerably influence the yield and LER-values. There were considerable differences between pea cultivars in their suitability for intercropping with barley.

47334 **(RISO-M—2477) Nitrogen supply of crops by biological nitrogen fixation. 5. Occurrence and efficiency with respect to nitrogen fixation of the root nodule bacteria.** Jensen, E.S.; Engvild, K.; Skoet, L.; Soerensen, L.H. (Risoe National Lab., Roskilde (Denmark)). Apr 1985. 66p. (In Danish). NTIS (US Sales Only), PC A04/MF A01. File Number DE85752649.

The occurence of R. leguminosarum in 44 Danish soils was studied by plant-infection counts. Allmost all soils contained $10^3$ to $10^4$ bacteria/g soil. The variation in efficiency with respect to $N_2$ fixation of randomly selected isolates from natural populations of R.

leguminosarum and the interaction between pea cultivar - R. leguminosarum strain were studied in pot experiments. Inoculation of peas with efficient R. leguminosarum strains, marked with streptomycin resistance, wasstudied in field experiments, where indigenous strains of R. leguminosarum were present.

# 56 BIOMEDICAL SCIENCES, APPLIED STUDIES

## 5601 Radiation Effects

*REFER ALSO TO CITATION(S) 46890, 46891*

47335 (ANL—84-103-Pt.2, pp 49-52) **Unexpected pattern of human cell survival following alpha-particle irradiation in vitro.** Schlenker, R.A.; Thompson, E.G.; Oltman, B.G. Apr 1985. NTIS, PC A09/MF A01. File Number DE85011174.

In Environmental Research Division annual report: Center for Human Radiobiology, July 1983-June 1984. Part 2.

Normal human fibroblasts were irradiated with alpha particles. Cell survival was significantly higher when the average linear energy transfer of the alpha spectrum was higher, contrary to expectation.

47336 (ANL—84-103-Pt.2, pp 1) **Recent case of radium-induced malignancy.** Adams, E.E. Apr 1985. NTIS, PC A09/MF A01. File Number DE85011174.

In Environmental Research Division annual report: Center for Human Radiobiology, July 1983-June 1984. Part 2.

One new case of malignant disease attributed to radium in a patient with a measured body burden has been reported since 1981; this case, with a squamous cell carcinoma of the left mastoid, is summarized. Born in 1904, this woman was employed as a dial painter in an Illinois plant for 27 months (1924-1926). She pointed the brush in her mouth. When measured at Argonne in 1957 her radium body burden was reported to be 0.420 μCi and x-ray changes thought to be due to radium were noted in most of her bones. The mastoids were recorded as densely sclerotic. In July 1983, she was hospitalized for complaints of left ear drainage and left seventh nerve paralysis. Exploratory surgery of the left mastoid revealed a squamous cell carcinoma, which was removed. Postoperatively the patient was given local radiotherapy and she is still living. The estimated average absorbed dose to her skeleton from the ingested radium is 4228 rads.

47337 (ANL—84-103-Pt.2, pp 2-14) **Current (1984) status of the study of $^{226}$Ra and $^{228}$Ra in humans at the Center for Human Radiobiology.** Rundo, J.; Keane, A.T.; Lucas, H.F.; Schlenker, R.A.; Stebbings, J.H.; Stehney, A.F. Apr 1985. NTIS, PC A09/MF A01. File Number DE85011174. (CONF-8410147—).

From Radiobiology of radium and thorotrast conference; Neuherberg, F.R. Germany (29 Oct 1984).

The Center for Human Radiobiology has identified 5784 persons by name and type of exposure to $^{226}$Ra and $^{228}$Ra. Included are 4863 dial painters (mostly women) and non-laboratory employees of the radium dial industry, 410 laboratory workers, 399 persons who received radium for supposed therapeutic effects, and 112 in other categories. Body contents of radium have been measured in 1916 of the dial workers and about one-half of the subjects in the other groups. Bone sarcomas, carcinomas of the paranasal sinuses and mastoids, and deterioration of skeletal tissue are still the only effects unequivocally attributable to internal radium. Excess leukemias have not been observed and other malignancies, if in excess, appear more likely to be related to external gamma radiation or radon than to internal radium. Positive correlations with radium burdens have been found for the incidence of benign exostoses among subjects exposed to radium before age 18 and for shortened latency of ocular cataracts. 27 references, 3 figures, 5 tables.

47338 (ANL—84-103-Pt.2, pp 15) **Mortality from cancers of major sites in female radium dial workers.** Stebbings, J.H.; Lucas, H.F.; Stehney, A.F. Apr 1985. NTIS, PC A09/MF A01. File Number DE85011174.

In Environmental Research Division annual report: Center for Human Radiobiology, July 1983-June 1984. Part 2.

Female radium dial workers have not experienced significant mortality from cancers other than the bone sarcomas and head carcinomas long known to be radium induced. The relationships of radium exposure to mortality from cancers of the stomach, pancreas, colon, rectum, liver, lung, breast, cervix, and corpus uteri, and from leukemia were studied in 1285 pre-1930 dial workers. Mortality was compared with that expected from rates for US white females, with and without adjustment for local area mortality rates, and with mortality in dial workers exposed from 1930 to 1949. For the 693 cases whose body content of radium has been measured since 1955, dose-response relationships of cancer to systemic intake of radium and duration of employment were examined. Liver, pancreatic, cervical, and uterine cancers were clearly unrelated to radium exposure. Other cancers of the digestive tract appeared to be indirectly, if at all, associated with work in radium facilities. Lung cancer requires further investigation; inhalation exposures of the dial workers are reviewed. Analyses of the breast cancer data uncovered several observations inconsistent with the previously suggested causal association with radium exposure. Multiple myeloma was also reviewed. A three-fold excess risk of death due to multiple myeloma has occurred, but is more closely correlated with duration of employment (a surrogate for external gamma radiation) than with radium intake.

47339 (ANL—84-103-Pt.2, pp 16-17) **Current CHR exhumation program.** Stehney, A.F.; Hamilton, G.J. Apr 1985. NTIS, PC A09/MF A01. File Number DE85011174.

In Environmental Research Division annual report: Center for Human Radiobiology, July 1983-June 1984. Part 2.

The Center for Human Radiobiology exhumation program was reactivated in 1983 with efforts concentrated on the 24 unmeasured radium cases with probable or confirmed bone sarcomas. These cases have provided valuable data on the amounts of skeletal distribution of radium, ratios of $^{223}$Ra to $^{226}$Ra, and the early time development of skeletal changes due to radium. In one case a suspected bone sarcoma was ruled out by inspection of the skeletal remains. However, the total number exhumed falls far short of the estimate of 500 cases needed to complete the study of early dial painters and iatrogenic cases. The chief difficulty has been in obtaining permission to exhume from the surviving next-of-kin, who number 5 or more for some cases. 1 reference, 1 table.

47340 (ANL—84-103-Pt.2, pp 18-22) **Production technique for thin undecalcified bone sections suitable for autoradiography.** Farnham, J.E.; Schlenker, R.A. Apr 1985. NTIS, PC A09/MF A01. File Number DE85011174.

In Environmental Research Division annual report: Center for Human Radiobiology, July 1983-June 1984. Part 2.

The production of thin bone sections using power-driven grinding equipment is described. With such equipment, sections can be readily ground to thicknesses between 30 and 40 μm in a rapid and controlled fashion. The yield of usable sections is nearly 100%.

47341 (ANL—84-103-Pt.2, pp 44-48) **Radium-induced dental changes in humans and beagles: a comparative microradiographic study.** Farnham, J.E.; Morgan, J.P.; Pool, R.R.; Miyabayashi, T. Apr 1985. NTIS, PC A09/MF A01. File Number DE85011174.

In Environmental Research Division annual report: Center for Human Radiobiology, July 1983-June 1984. Part 2.

Microradiographs made from thin sections of teeth of humans carrying skeletal deposits of $^{226}$Ra and $^{228}$Ra and of beagles injected with $^{226}$Ra showed similar patterns of change with age. The patterns consisted of the presence of remodeling units of alveolar bone that extended across the gomphosis and involved the cementum and dentine. This is not described as a normal aging change in humans or beagles. 3 tables.

47342 (ANL—84-103-Pt.2, pp 74) **Measurement of lymphoblastogenic activity from thorium workers.** Serio, C.S.; Renning, C.B.; Toohey, R.E.; Lloyd, E.L. Apr 1985. NTIS, PC A09/MF A01. File Number DE85011174.

In Environmental Research Division annual report: Center for Human Radiobiology, July 1983-June 1984. Part 2.

Mitogenic stimulation of peripheral blood lymphocyte cultures obtained from 36 thorium workers was studied to determine whether the response of these cells was affected by the individuals occupational exposure to alpha irradiation. The standard assay involved incubating 2 x $10^5$ lymphocytes per test well for 72 hours in the presence of phytohemagglutinin (PHA), concanavalin A (Con A) or pokeweed mitogen (PWM). The results showed that there was a significant decrease in lymphocyte responsiveness of former thorium workers grouped by decade of life when compared with controls of the same decade of life for each mitogen tested with the exceptions of PHA in the 41-50 age group and PWM in the 51-60 age group. The authors were unable to correlate the decreased response observed with the measured body burdens, external gamma exposure, or thoron exhalation rates in these thorium cases. However, other occupational exposures (i.e., various chemicals used in processing thorium) cannot be eliminated as a possible cause.

47343 (ANL—84-103-Pt.2, pp 23-43) **Distribution of radium and plutonium in human bone.** Schlenker, R.A. Apr 1985. NTIS, PC A09/MF A01. File Number DE85011174. (CONF-8410161—).

From 18. European symposium on calcified tissue; Angers, France (11 Oct 1984).

This review covers studies of the microdistribution of radium and plutonium in human bone, conducted at Argonne with emphasis on the alpha-spectrometric method of measurement. Alpha spectrometry offers high spatial resolution and is well suited to the measurement of radionuclide concentrations near bone surfaces. With these techniques surface deposit thicknesses have been measured to be about 1 μm thick for isotopes of lead, radium and the actinides, and volume deposits of $^{226}$Ra have been found to be quite nonuniform near bone surfaces, leading to endosteal tissue dose rates that are higher than expected under the assumption of uniform volume concentration normally used in radiation protection calculations. With autoradiography, the bony septa of the mastoid air cell system have been found to be depleted in radium relative to the bone tissue surrounding them; this is expected to have a significant influence on the dosimetry of the mastoid epithelia. A combination of autoradiographic and morphometric measurements indicates that specific activities in the axial skeleton are higher than in the appendicular skeleton, primarily because the former has higher bone surface-to-volume ratios and higher bone surface concentrations of plutonium. 19 references, 14 figures, 6 tables.

47344 (ANL—84-103-Pt.2, pp 53-59) **Activity ratios of thorium daughters in vivo.** Toohey, R.E.; Rundo, J.; Sha, J.Y.; Essling, M.A.; Pedersen, J.C.; Slane, J.M. Apr 1985. NTIS, PC A09/MF A01. File Number DE85011174. (CONF-8410147—).

From Radiobiology of radium and thorotrast conference; Neuherberg, F.R. Germany (29 Oct 1984).

A computerized method of least squares fitting has been used to analyze the $^{228}$Ac and $^{212}$Pb-$^{212}$Bi and daughter γ-ray spectra obtained in vivo from 133 former workers at a thorium refinery. In addition, the exhalation rate of $^{220}$Rn was determined for each subject and expressed as pCi of emanating $^{224}$Ra. This value was added to the $^{212}$Pb value determined from the γ-ray measurements to obtain the total $^{224}$Ra present, and the ratio of $^{224}$Ra to $^{228}$Ac was calculated. Values of the ratio ranged from 0.52 +- 0.32 to 2.1 +- 1.7, with a weighted mean of 0.92 +- 0.17. However, it appears that the ratio observed in a given case is characteristic for that case alone; the computed mean value may not be meaningful. The least squares fitting procedure and the overall calibration of the counting system were validated by comparing measurements of $^{224}$Ra in the lungs of one subject postmortem with results obtained from the same subject in vivo. 6 references, 5 figures.

47345 (ANL—84-103-Pt.2, pp 60-73) **Personal factors affecting thoron exhalation from occupationally acquired thorium body burdens.** Stebbings, J.H. Apr 1985. NTIS, PC A09/MF A01. File Number DE85011174.

In Environmental Research Division annual report: Center for Human Radiobiology, July 1983-June 1984. Part 2.

Thorium workers with thorium body burdens (primarily thoracic) above 0.7 nCi $^{224}$Ra equivalent are shown to exhale about 15% of thoron produced in vivo, compared to 5% exhaled by subjects with body burdens in the range of 0.4 to 0.7 nCi $^{224}$Ra. There was a false negative correlation between average adult daily cigarettes smoked and thoron exhalation. White blood cell counts that were about 85% of expected were observed in seven subjects exhaling ≧ 100 pCi of thoron above predicted; no other variable examined showed a clear pattern of association. These differences in fractional thoron exhalation, and their consequences, are discussed. 3 references, 4 figures, 8 tables.

47346 (ANL—84-103-Pt.2, pp 75-84) **Argonne-Utah studies of $^{224}$Ra endosteal surface dosimetry.** Schlenker, R.A.; Smith, J.M. Apr 1985. NTIS, PC A09/MF A01. File Number DE85011174. (CONF-8410147—).

From Radiobiology of radium and thorotrast conference; Neuherberg, F.R. Germany (29 Oct 1984).

The activities of $^{212}$Pb relative to $^{224}$Ra and of $^{223}$Rn relative to $^{226}$Ra were measured in bone surface deposits 24 h after injection of radium into beagles. The fractional retention of $^{220}$Rn atoms was measured in vitro with hydrated and dehydrated bone samples to determine the effect of water content on the escape of radon from bone surfaces. The experimental data suggest that substantial $^{224}$Ra daughter-product disequilibrium exists in bone surface deposits. Estimates for the lower and upper limits on the fractional retention of $^{220}$Rn in vivo are 0.05 and 0.25, respectively. The average bone surface activity of $^{212}$Pb relative to $^{224}$Ra ranged from 0.34 to 0.71 for four dogs, with the majority of the values toward the lower end of the range. Only a small portion of the deposited $^{212}$Pb came from lead in the injection solution despite near equilibrium between $^{224}$Ra and its daughters at the time of injection. The retention data indicate that the endosteal tissue dose rate in the dogs at one day was actually one-third to about one-half that which would be calculated assuming equilibrium of $^{224}$Ra daughter products in bone surface deposits. 11 references, 2 figures, 7 tables.

47347 (ANL—84-103-Pt.2, pp 85) **Retention of plutonium in the beagle after gastrointestinal absorption.** Toohey, R.E.; Bhattacharyya, M.H.; Oldham, R.D.; Larsen, R.P.; Moretti, E.S. Apr 1985. NTIS, PC A09/MF A01. File Number DE85011174.

In Environmental Research Division annual report: Center for Human Radiobiology, July 1983-June 1984. Part 2.

A 0.01 M bicarbonate solution containing 130 nCi (~ 5 kBq) of $^{237}$Pu (90% hexavalent, 93% ultrafilterable) was administered via gelatin capsule to six adult male beagles following a 21-hr fast. The dogs were sacrificed after 5-6 weeks and the percentage of the administered plutonium retained in the liver plus skeleton and its distribution within the skeleton were determined. The mean amount retained in these tissues was (0.063 +- 0.006)% of the administered dose. The mean amounts of plutonium in the liver and the skeleton were approximately equal, and the distribution within the skeleton was similar to that observed by other workers following either intravenous injection or inhalation. The value for plutonium retention by the dog is about a factor of three less than the values the authors have reported for rodents. It is a factor of 7 greater than the product of the values for gastrointestinal absorption ($f_1$) and fractional retention ($f_R$) recommended by the ICRP for man.

47348 (ANL—84-103-Pt.2, pp 86-90) **Plutonium metabolism in the baboon and the dog - comparison of the behaviors of absorbed and injected isotopes and determination of gastrointestinal absorption.** Bhattacharyya, M.H.; Larsen, R.P.; Oldham, R.D.; Moretti, E.S.; Savaglio, C.C. Apr 1985. NTIS, PC A09/MF A01. File Number DE85011174.

In Environmental Research Division annual report: Center for Human Radiobiology, July 1983-June 1984. Part 2.

Two isotopes of plutonium were administered simultaneously to a baboon and two to a dog, one intragastrically and one intravenously. Samples of urine, blood, and tissues were taken and analyzed. The results indicate that the metabolism of absorbed plutonium is the same as that of injected plutonium. They also show that the value for the fractional absorption of plutonium from the GI tract can be calculated from the amounts of the isotopes administered and the value of the ratio of their concentrations in a single sample of urine, blood, or tissue. 3 references, 1 table.

47349 **(CEA-CONF—7680) Study of the interaction of cysteamine and cystamine with the dipalmitoyl phosphatidylcholine.** Berleur, F.; Roman, V.; Jaskierowicz, D.; Audet, M.; Fatome, M. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Oct 1984. 7p. (In French). (CONF-8410286—2). NTIS (US Sales Only), PC A02/MF A01. File Number DE85752169.

From 17. OTAN specialists meeting on chemoprophylaxis; Brussels, Belgium (23 Oct 1984).

The thermodynamic study of the liposome-radioprotector system brings information on this interaction. The interaction is essentially electrostatic between the phosphate sites and the radioprotector cationic groups and this study could bring further information about the interaction between cysteamine and polyelectroiytic structures, DNA for example, and about the radioprotective properties of this drug.

47350 **(CEA-CONF—7692) Oral administration of liposome encapsulated cysteamine and distribution in blood, liver and spleen.** Jaskierowicz, D.; Genissel, F.; Roman, V.; Fatome, M.; Berleur, F. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Oct 1984. 4p. (In French). (CONF-8410286—1). NTIS (US Sales Only), PC A02/MF A01. File Number DE85752168.

From 17. OTAN specialists meeting on chemoprophylaxis; Brussels, Belgium (23 Oct 1984).

A previous study has demonstrated the protracted radioprotective action of liposome encapsulated cysteamine after oral administration. The present study has confirmed that oral administration of cysteamine incorporated in liposomes induces molecule protection and increases the concentration of thiols and sulfur compounds in blood and plasma. This result seems to be in relation with the radioprotective action of such preparations.

47351 **(CEA-CONF—7716) Interaction of a radioprotector WR 2721, with artificial membranes. EPR study.** Roman, V.; Camuzeau, C.; Fatome, M.; Berleur, F. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Jul 1984. 1p. (In French). (CONF-8407128—1). NTIS (US Sales Only), PC A02/MF A01. File Number DE85752167.

From International meeting on therapeutical chemistry; Chatenay-Malabry, France (10 Jul 1984).

Published in summary form only.

47352 **(CEA-CONF—7724) Effect of cysteamine, a divalent-like molecule on polar head groups in DPPC model membrane. A spin label, DSC (differential scanning calorimetry) and turbidimetry studies.** Berleur, F.; Roman, V.; Jaskierowicz, D.; Leterrier, F.; Fatome, M. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Feb 1984. 1p. (CONF-8407121—3). NTIS (US Sales Only), PC A02/MF A01. File Number DE85752170.

From 5. international symposium on surfactants in solution; Bordeaux, France (9 Jul 1984).

Published in summary form only.

47353 (CONF-791122—Absts., pp 14) **Radiation control of the Japanese uranium mines'.** Kurosawa, Ryuhei (Waseda Univ., Tokyo (Japan). School of Science and Engineering); Nakashima, Keuji; Sugita, Noboru; Tanaka, Hidetaka (Power Reactor and Nuclear Fuel Development Corp., Tokyo (Japan)). 1979. NTIS (US Sales Only), PC A04/MF A01. File Number DE82904129. (INIS-mf—9485).

From 2. Asian regional congress on radiation protection; Manila, Philippines (5 Nov 1979).

Published in abstract form only.

47354 (CONF-791122—Absts., pp 17) **Medical radiation exposure: an unaffordable risk.** Robotham, F.P.J. (Melbourne Univ., Parkville (Australia)). 1979. NTIS (US Sales Only), PC A04/MF A01. File Number DE82904129. (INIS-mf—9485).

From 2. Asian regional congress on radiation protection; Manila, Philippines (5 Nov 1979).

Published in abstract form only.

47355 (CONF-791122—Absts., pp 18) **Radiation protection survey of diagnostic X-rays and radiotherapeutic units in Republic of China.** Liu, Kuo-Yueh; Tsai, Cheng-Tzong (Atomic Energy Council of Executive Yuan, Taipei, Taiwan 106); Tsai, Chao-Ming; Chen, Wei-Li; Chou, Kei-Den (Health Physics Division, Inst. of Nuclear Research, Atomic Energy Council, Taiwan). 1979. NTIS (US Sales Only), PC A04/MF A01. File Number DE82904129. (INIS-mf—9485).

From 2. Asian regional congress on radiation protection; Manila, Philippines (5 Nov 1979).

Published in abstract form only.

47356 (CONF-791122—Absts., pp 19) **Quality assurance in diagnostic radiology.** Wei-kom; Wunder, Chu B.P.; Ferguson, S.; Laws, G.; Vanhoutte, J.J.; Swirczynski, T. (Oklahoma Univ., Oklahoma City (USA). Health Sciences Center). 1979. NTIS (US Sales Only), PC A04/MF A01. File Number DE82904129. (INIS-mf—9485).

From 2. Asian regional congress on radiation protection; Manila, Philippines (5 Nov 1979).

Published in abstract form only.

47357 (CONF-791122—Absts., pp 20) **Survey of radiation doses in special procedures in three New Zealand hospitals.** Luketina, I.A.; LeHeron, J.C. (National Radiation Laboratory, Christchurch (New Zealand)). 1979. NTIS (US Sales Only), PC A04/MF A01. File Number DE82904129. (INIS-mf—9485).

From 2. Asian regional congress on radiation protection; Manila, Philippines (5 Nov 1979).

Published in abstract form only.

47358 (CONF-791122—Absts., pp 21) **Radiation dose survey in two New Zealand hospitals.** Luketina, I.A.; LeHeron, J.C. (National Radiation Laboratory, Christchurch (New Zealand)). 1979. NTIS (US Sales Only), PC A04/MF A01. File Number DE82904129. (INIS-mf—9485).

From 2. Asian regional congress on radiation protection; Manila, Philippines (5 Nov 1979).

Published in abstract form only.

47359 (CONF-791122—Absts., pp 25) **Assessment of tritium body-burden in radiation workers by urinalysis.** Juan, N.B.; Garcia, T.Y. (Health Physics Research Div., Philippine Atomic Energy Commission, Diliman, Quezon City). 1979. NTIS (US Sales Only), PC A04/MF A01. File Number DE82904129. (INIS-mf—9485).

From 2. Asian regional congress on radiation protection; Manila, Philippines (5 Nov 1979).

Published in abstract form only.

47360 (CONF-791122—Absts., pp 26) **Measurements of absorbed dose externally exposed to beta rays using survey meters.** Suga, Shin-Ichi; Bingo, Kazuyoshi; Koshida, Masami; Kajimoto, Yoichi (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). 1979. NTIS (US Sales Only), PC A04/MF A01. File Number DE82904129. (INIS-mf—9485).

From 2. Asian regional congress on radiation protection; Manila, Philippines (5 Nov 1979).

Published in abstract form only.

47361 (CONF-791122—Absts., pp 28) **Active marrow dose distributions inside the pelvis and spine of two heterogenous phantoms' exposure to some diagnostic radiographic examination.** Chen Wei-Lei (Health Physics Div., Inst. of Nuclear Energy Research, Atomic Energy Council, Taiwan). 1979. NTIS (US Sales Only), PC A04/MF A01. File Number DE82904129. (INIS-mf—9485).

From 2. Asian regional congress on radiation protection; Manila, Philippines (5 Nov 1979).

Published in abstract form only.

47362 (CONF-791122—Absts., pp 30) **Progress of film badge service of the radiation personnel monitoring in Japan.** Arakawa, N.; Yamada, K.; Saito, T. (Chiyoda Safety Appliance Co. Ltd., Tokyo (Japan)). 1979. NTIS (US Sales Only), PC A04/MF A01. File Number DE82904129. (INIS-mf—9485).

From 2. Asian regional congress on radiation protection; Manila, Philippines (5 Nov 1979).

Published in abstract form only.

47363 (CONF-791122—Absts., pp 32) **Monitoring of low-level environmental gamma exposure by the centralized radiation monitoring system.** Ito, Naoji; Katagiri, Hiroshi; Kobayashi, Hideo; Obata, Kazuichi; Iijima, Toshinori; Imai, Kazuhiko; Kokubu, Morinobu (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). 1979. NTIS (US Sales Only), PC A04/MF A01. File Number DE82904129. (INIS-mf—9485).

From 2. Asian regional congress on radiation protection; Manila, Philippines (5 Nov 1979).

Published in abstract form only.

47364 (CONF-791122—Absts., pp 35) **Trend and experience of dose measurement in radiation protection for rapidly growing industry and medical practice.** Weng Pao-shan (Nuclear Science and Technology Development Center, National Tsing Hua Univ., Taiwan). 1979. NTIS (US Sales Only), PC A04/MF A01. File Number DE82904129. (INIS-mf—9485).

From 2. Asian regional congress on radiation protection; Manila, Philippines (5 Nov 1979).

Published in abstract form only.

47365 (CONF-791122—Absts., pp 37) **Investigation of occupational exposure to ionizing radiation in Taiwan for two decades.** Weng Pao-shan; Li Shu-ying (Nuclear Science and Technology Development Center, National Tsing Hua Univ., Hsinchu, Taiwan). 1979. NTIS (US Sales Only), PC A04/MF A01. File Number DE82904129. (INIS-mf—9485).

From 2. Asian regional congress on radiation protection; Manila, Philippines (5 Nov 1979).

Published in abstract form only.

47366 (CONF-791122—Absts., pp 40) **Note of radiation monitoring instruments in Japan.** Susuki, K.; Ikeda, T. (Department of Radiation Monitors Technical Div., Aloka Company, Limited, Tokyo (Japan)). 1979. NTIS (US Sales Only), PC A04/MF A01. File Number DE82904129. (INIS-mf—9485).

From 2. Asian regional congress on radiation protection; Manila, Philippines (5 Nov 1979).

Published in abstract form only.

47367 (CONF-8504162—) **Workshop on radiobiological effectiveness of neutrons.** Stapleton, G.E.; Thomas, R.G.; Thiessen, J.W. (USDOE Office of Energy Research, Washington, DC. Office of Health and Environmental Research). Sep 1985. 36p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85017577.

From Workshop on radio biological effectiveness of neutrons; Germantown, MD, USA (9 Apr 1985).

The radiobiological effectiveness (RBE) of neutrons has become the subject of some heated discussions in both scientific and radiation-protection oriented communities. This has become especially so since the realization that neutron exposures of A-bomb survivors in Hiroshima were considerably lower than previously assumed, thus "devaluating" the importance of what we thought was a solid human data base. At the same time, more recent data from radiobiological research appeared to indicate that, at least for some biological endpoints, the RBE of neutrons at low doses and low dose rates was increased dramatically compared to the RBE at higher dose and dose rates. As a consequence, the protection of health against neutrons became a subject of some urgency. The objective of this workshop was to evaluate the existing data base in order to determine the need for additional research in this field. 22 refs., 3 figs., 6 tabs.

47368 (DOE/ER/60118—T1) **Confirmation of selected milk and meat radionuclide transfer coefficients. Third technical progress report, September 1984-August 1985.** Ward, G.M.; Johnson, J.E. (Colorado State Univ., Fort Collins (USA)). 31 Aug 1985. Contract AC02-83ER60118. 31p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85017970.

The goat milk transfer coefficient of Tc administered as $TcO_4^-$ was found to be 20 to 40 times that of Tc administered in a reduced form. The fraction of Tc, as $TcO_4^-$, transferred from gut to blood was approximately 6 to 10 times that of reduced Tc. The milk transfer coefficient of Tc administered as $TcO_4^-$ was 6 to 8 times greater for goats than cows. The fraction of Tc, as $TcO_4^-$, absorbed from the gut by cows, however, was approximately twice that absorbed by goats. The mean time for loss of Tc in cows' milk based on the average values plotted in Figure 2 was approximately 10 hours. The fraction of Tc, administered as $TcO_4^-$, absorbed from blood to mammary gland by cows was estimated to be approximately 2% that of goats. 4 refs., 15 tabs.

47369 (EUR—9088) **Progress report 1983. Programme. Radiation protection.** (Commission of the European Communities, Luxembourg). 1984. 1363p. (In several languages). Commission of the European Communities, Luxembourg.

The research activities of the Radiation Protection programme in 1983 are summarized, the results of about 400 projects from contracts with national institutions and universities in the member states are presented under six headings: radiation dosimetry and its interpretation; behaviour and control of radionuclides in the environment; short-term somatic effects of ionizing radiation; late somatic effects of ionizing radiation; genetic effects of ionizing radiation; evaluation of radiation risks. Each report gives details of the contractor, the head of the research team, the general subject of the contract and the list of projects involved.

47370 (INIS-mf—9742, pp 229-234) **Microdistribution of calcium $^{45}Ca$ in long bones of experimental animals.** Mysak, F.; Krejci, M. (Statni Vyzkumny Ustav Materialu, Prague (Czechoslovakia)); Lener, J. (Institut Hygieny a Epidemiologie, Prague (Czechoslovakia)); Bibr, B. (Ceskoslovenska Akademie Ved, Prague. Isotopova Laborator Biologickych Ustavu). 1983. NTIS (US Sales Only), PC A12/MF A01. File Number DE85781598. (CONF-8305206—).

From 13. international symposium on autoradiography; Tabor, Czechoslovakia (2 May 1983).

The effect of fluoride ions given in a low concentration corresponding to that in drinking water on the metabolism of calcium in mechanically damaged long bones of rats was studied in experiments. $^{45}Ca$lcium microdistribution in the growth zone and callus was studied using contact autoradiography of bone cuts on ORWO AF 4 nuclear emulsions. Photometry of the autoradiographs revealed differences between animals exposed to fluoride ions. (author).

47371 (INIS-mf—9742, pp 238-252) **Autoradiographic investigation of distribution of $^{58}Co$ binding in mouse lungs following inhalation.** Hoelzer, F.; Laussmann, D.; Schubert, K. (Staatliches Amt fuer Atomsicherheit und Strahlenschutz, Berlin (German Democratic Republic)); Zglinicki, Th.v. (Humboldt-Universitaet, Berlin (German Democratic Republic). Bereich Medizin (Charite)). 1983. (In German). NTIS (US Sales Only), PC A12/MF A01. File Number DE85781598. (CONF-8305206—).

From 13. international symposium on autoradiography; Tabor, Czechoslovakia (2 May 1983).

The knowledge of microscopic distribution of inhaled radionuclide has considerable importance for the evaluation of its physicochemical behaviour in lung tissue. The results are presented of the autoradiographic study of the microscopic distribution of $^{58}CoCl_2$ and $^{58}Co_3O_4$ in the lungs. Following $^{58}CoCl_2$ inhalation a homogeneous distribution was found in the lung tissue while after the inhalation of $^{58}Co_3O_4$ the local concentration prevails in the bronchial and alveolar macrophages. $^{58}Co_3O_4$ belongs among compounds which are very difficult to dissolve in biological material and prevail concentrated in a specific sites of the lung tissue even

after several months. Autoradiography and electron microscope examination allowed to localize $^{60}Co_3O_4$ inside the cells. (author).

47372 (INIS-mf—9743) **Application of ionizing radiation in foods and feeds treatment.** Hanis, T. (ed.). (Ceskoslovenska Komise pro Atomovou Energii, Prague; Ceskoslovenska Akademie Ved, Prague. Fyziologicky Ustav). 1984. 67p. (In Czech). (CONF-8411173—). NTIS (US Sales Only), PC A04/MF A01. File Number DE85781606.

From Seminar on application of ionizing radiation in foods and feeds treatment; Prague, Czechoslovakia (28 Nov 1984).

The proceedings contain 21 papers presented at the seminar which was held in Prague on November 28, 1983. The topic of the papers was current knowledge of ionizing radiation applications for treating foodstuffs and feeds and the confrontation of the applications thereof in Czechoslovakia and elsewhere in the world. (J.P.).

47373 (INIS-mf—9743, pp 7-8) **Concept of development of radiation technologies in the CSSR.** Horacek, P. (Ceskoslovenska Komise pro Atomovou Energii, Prague). 1984. (In Czech). NTIS (US Sales Only), PC A04/MF A01. File Number DE85781606. (CONF-8411173—).

From Seminar on application of ionizing radiation in foods and feeds treatment; Prague, Czechoslovakia (28 Nov 1984).

Published in summary form only.

47374 (INIS-mf—9743, pp 9-12) **Treatment of foods and feeds with ionizing radiation.** Hanis, T.; Pospisil, M. (Ceskoslovenska Akademie Ved, Prague. Fyziologicky Ustav). 1984. (In Czech). NTIS (US Sales Only), PC A04/MF A01. File Number DE85781606. (CONF-8411173—).

From Seminar on application of ionizing radiation in foods and feeds treatment; Prague, Czechoslovakia (28 Nov 1984).

According to FAO estimates one fourth to one third of the world food production is destroyed in the post-harvest period. The treatment of foodstuffs with ionizing radiation is compared with traditional preservation procedures with regard to energy demand, chemical damage and operation economy. Types of ionizing radiation sources permitted for such applications are given. The average absorbed dose should in commercial uses not exceed 10 kGy. Examples of possible uses are summed up in tables. (E.F.).

47375 (INIS-mf—9743, pp 25-27) **Effect of sterilizing doses of ionizing radiation on contents of vitamins A, $B_1$ and $B_2$ in cereal-based mixes.** Mnukova, J.; Hanis, T. (Institut Hygieny a Epidemiologie, Prague (Czechoslovakia)). 1984. (In Czech). NTIS (US Sales Only), PC A04/MF A01. File Number DE85781606. (CONF-8411173—).

From Seminar on application of ionizing radiation in foods and feeds treatment; Prague, Czechoslovakia (28 Nov 1984).

The diets were irradiated with doses of 25 kGy (diet I) an and 50 kGy (diet II) and stored for 79 days at room temperature with free access of air. In one month intervals the contents of the said vitamins were determined, this also for non-sterilized diets. No significant deviation was found in diet I and in the non-sterilized diet. In diet II the content of vitamin A and thiamine dropped mildly. As compared to autoclaving the decline is smaller. (E.F.).

47376 (INIS-mf—9743, pp 28-30) **Effect of ionizing radiation on stability of vitamins A and E in feed additives.** Toulova, M.; Pisarikova, B.; Herzig, I.; Hampl, J. (Vyzkumny Ustav Veterinarniho Lekarstvi, Brno-Medlanky (Czechoslovakia)). 1984. (In Czech). NTIS (US Sales Only), PC A04/MF A01. File Number DE85781606. (CONF-8411173—).

From Seminar on application of ionizing radiation in foods and feeds treatment; Prague, Czechoslovakia (28 Nov 1984).

The Selasan milk feed mix was sterilized with gamma radiation with a dose of 25 kGy. The decrease in vitamin A after irradiation (by order of %) is graphically compared with non-irradiated mixes. As compared with thermal sterilization of feeds the vitamin A losses are smaller. The loss is influenced by the oxidation products of fats whose amount increases upon the irradiation of the high fat diet. The irradiation of the 33% E vitamin concentrate did not affect its concentration. The vitamin E content of the bio additive dropped by 3.19% after irradiation. Technological measures are suggested for reducing oxidation processes in the fat component of the feed during irradiation. (E.F.).

47377 (INIS-mf—9743, pp 31-33) **Application of ionizing radiation in treatment of meat.** Sedlackova, J. (Ustav Jaderneho Vyzkumu CSKAE, Rez (Czechoslovakia)). 1984. (In Czech). NTIS (US Sales Only), PC A04/MF A01. File Number DE85781606. (CONF-8411173—).

From Seminar on application of ionizing radiation in foods and feeds treatment; Prague, Czechoslovakia (28 Nov 1984).

Processes used for meat treatment for storage (cooling, radurization + cooling, freezing, heat treatment and radappertization) are compared with regard to energy demand. The effect of doses above 10 kGy and below 10 kGy are discussed. Doses of ionizing radiation may be combined with other techniques (heat treatment, the addition of certain chemicals or antibiotics). Czechoslovak experience with irradiation of meat with tapeworm cysticerci is described. (E.F.).

47378 (INIS-mf—9743, pp 44-46) **Possibilities of detecting radiation-treated foodstuffs.** Duchacek, V. (Ustav pro Vyzkum, Vyrobu a Vyuziti Radioisotopu, Prague (Czechoslovakia)). 1984. (In Czech). NTIS (US Sales Only), PC A04/MF A01. File Number DE85781606. (CONF-8411173—).

From Seminar on application of ionizing radiation in foods and feeds treatment; Prague, Czechoslovakia (28 Nov 1984).

The indicator, range of applied doses and method of detection of radiation treatment of foods are given for meat, fats, fish, other sea products, fruits, mushrooms, sugars, starches, cereals and potatoes. (J.P.).

47379 (INIS-mf—9743, pp 47-49) **Principles of industrial irradiation and design of industrial gamma sources.** Santar, I. (Statni Vyzkumny Ustav Textilni, Veverska Bityska (Czechoslovakia)). 1984. (In Czech). NTIS (US Sales Only), PC A04/MF A01. File Number DE85781606. (CONF-8411173—).

From Seminar on application of ionizing radiation in foods and feeds treatment; Prague, Czechoslovakia (28 Nov 1984).

The relations are given for the calculation of the decrease in source activity, the calculation of the production capacity of the source, the coefficient of energy utilization (eta) and ways of obtaining higher values of eta. Briefly described is the economy of gamma irradiation plants; the costs of irradiating 1 kg of product and the dose rate in irradiated material are given. (J.P.).

47380 (INIS-mf—9743, pp 59-62) **Exposure rates at $^{60}Co$ UVVR. Possible applications in radiation treatment of foods and feeds.** Pesek, M. (Ustav pro Vyzkum, Vyrobu a Vyuziti Radioisotopu, Prague (Czechoslovakia)). 1984. (In Czech). NTIS (US Sales Only), PC A04/MF A01. File Number DE85781606. (CONF-8411173—).

From Seminar on application of ionizing radiation in foods and feeds treatment; Prague, Czechoslovakia (28 Nov 1984).

Published in summary form only.

47381 (INIS-mf—9743, pp 65-67) **Experience with irradiation of table potatoes in the CSSR.** Kubin, K. (Vyzkumny Ustav Zemedelske Techniky, Prague (Czechoslovakia)). 1984. (In Czech). NTIS (US Sales Only), PC A04/MF A01. File Number DE85781606. (CONF-8411173—).

From Seminar on application of ionizing radiation in foods and feeds treatment; Prague, Czechoslovakia (28 Nov 1984).

In the years 1976 to 1980 the effect of gamma radiation on potatoes was tested. The following parameters were monitored: weight losses of tubers, sprouting and weight of sprouts, changes in chemical composition of tubers, the development of storage diseases and the interest of consumers in irradiated potatoes. The tests were made on 5 potato species. Irradiation was carried out in three time intervals with 60 Gy, 100 Gy and 150 Gy applied from a source with an activity of $4.07 \times 10^{14}$ Bq. Weight losses were on average higher in irradiated potatoes than in the control group. Positive was the reduced sprouting rate at 100 Gy. No substantial changes were found in chemical composition. The development of storage diseases was found to be more dependent on previous gathering and sorting, in some species it increased after irradiation in others it dropped after the 100 Gy dose. The inquiry failed and the

potatoes were sold without the buyers having expressed their views. (J.P.).

47382 (INIS-mf—9743, pp 34-35) **Experience with applications of ionizing radiation in breeding laboratory rats in BEM FgU sector of CSAV.** Burda, Z.; Lachout, J. (Ceskoslovenska Akademie Ved, Prague. Fyziologicky Ustav). 1984. (In Czech). NTIS (US Sales Only), PC A04/MF A01. File Number DE85781606. (CONF-8411173—).

From Seminar on application of ionizing radiation in foods and feeds treatment; Prague, Czechoslovakia (28 Nov 1984).

Published in summary form only.

47383 (INIS-mf—9743, pp 42-43) **Effect of radiation-sterilized diet on production of defined biomodels in large-scale breeding.** Boubelik, M.; Peknicova, J.; Pragerova, B. (Ustav Molekularni Genetiky CSAV, Prague (Czechoslovakia)). 1984. (In Czech). NTIS (US Sales Only), PC A04/MF A01. File Number DE85781606. (CONF-8411173—).

From Seminar on application of ionizing radiation in foods and feeds treatment; Prague, Czechoslovakia (28 Nov 1984).

The results are compared of two feed sterilization procedures (autoclaving and radappertization) used in large scale breeding of laboratory mice. Weight increase, the histology of reproductive organs and the number of newborns and their mortality were evaluated. The method of sterilization using ionizing radiation provides better results of all monitored parameters as compared with autoclaving. (E.F.).

47384 (INIS-mf—9758, pp vp) **Growth reduction of barley seeds after neutron, electron and photon irradiation.** Holmberg, P. (Helsinki Univ. (Finland). Dept. of Physical Medicine). 1984. NTIS (US Sales Only), PC A08/MF A01. File Number DE85781601. (CONF-8410282—Absts.).

From 7. Nordic Society for Radiation Protection ordinary meeting; Copenhagen, Denmark (10 Oct 1984).

Published in summary form only.

47385 (INIS-mf—9758, pp vp) **Radiation emitted by a nuclear-medical patient.** Ennow, K. (Statens Inst. for Straalehygiejne, Copenhagen (Denmark)). 1984. (In Danish). NTIS (US Sales Only), PC A08/MF A01. File Number DE85781601. (CONF-8410282—Absts.).

From 7. Nordic Society for Radiation Protection ordinary meeting; Copenhagen, Denmark (10 Oct 1984).

Published in summary form only.

47386 (INIS-mf—9758, pp vp) **Control of I-125 contamination of people by means of urine analysis.** Lewinsky, B. (Statens Inst. for Straalehygiejne, Copenhagen (Denmark)). 1984. (In Danish). NTIS (US Sales Only), PC A08/MF A01. File Number DE85781601. (CONF-8410282—Absts.).

From 7. Nordic Society for Radiation Protection ordinary meeting; Copenhagen, Denmark (10 Oct 1984).

Published in summary form only.

47387 (INIS-mf—9758, pp vp) **OIVA - a microcomputer-based system for dose calculations in reactor accidents.** Lahtinen, J. (Straalsaekerhetscentralen, Helsingfors, Finland). 1984. (In Swedish). NTIS (US Sales Only), PC A08/MF A01. File Number DE85781601. (CONF-8410282—Absts.).

From 7. Nordic Society for Radiation Protection ordinary meeting; Copenhagen, Denmark (10 Oct 1984).

Published in summary form only.

47388 (INIS-mf—9758, pp vp) **Measurement of lung burden (uranium-235) by means of 4 germanium detectors.** Gustafsson, J. (ASEA-ATOM AB, Vaesteraas (Sweden)). 1984. (In Swedish). NTIS (US Sales Only), PC A08/MF A01. File Number DE85781601. (CONF-8410282—Absts.).

From 7. Nordic Society for Radiation Protection ordinary meeting; Copenhagen, Denmark (10 Oct 1984).

Published in summary form only.

47389 (INIS-mf—9758, pp vp) **Cooperation agreement on radiation monitoring between the State Institute for Radiation Protection and Labor Inspection Service in Norway.** Bull, A. (Universitetet i Oslo, Norway). 1984. (In Norwegian). NTIS (US Sales Only), PC A08/MF A01. File Number DE85781601. (CONF-8410282—Absts.).

From 7. Nordic Society for Radiation Protection ordinary meeting; Copenhagen, Denmark (10 Oct 1984).

Published in summary form only.

47390 (INIS-mf—9758) **Nordic Society for Radiation Protection 7th ordinary meeting.** (Nordisk Selskab for Straalebeskyttelse, Helsinki (Finland)). 1984. 162p. (In Swedish). (CONF-8410282—Absts.). NTIS (US Sales Only), PC A08/MF A01. File Number DE85781601.

From 7. Nordic Society for Radiation Protection ordinary meeting; Copenhagen, Denmark (10 Oct 1984).

Published in summary form only.

Items within the scope of EDB have been entered individually into the data base. (ACR)

47391 (JINR—R-19-84-655) **Factors determinating the shape of survival curves of Escherichia coli cells irradiated by ionizing radiation with different LET. The dependence of the shape of survival curve on LET.** Kozubek, S.; Krasavin, E.A.; Fajsi, Ch. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1984. 8p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE85702140.

The dependence of the shape of bacterial survival curve in the case of Escherichia coli Wild type, rec$^-$ and pol$^-$ mutants on linear energy transfer is considered. When increasing LET of the radiation the shouldered survival curves are transformed to exponential ones. In the case of sensitive mutants the transformation is observed for smaller values of LET. The dependence of cell sensitivity on LET calculated on the basis of Landau-Vavilov distribution is compared with earlier calculations. The comparison showed a good agreement between two methods of calculation for ions with 4 MeV per nucleon energy.

47392 (JINR-R—19-84-647) **Factors determinating the shape of survival curves of Escherichia coli cells irradiated by ionizing radiation with different LET. The shape of survival curves of the wild type cells irradiated by gamma-rays.** Kozubek, S.; Krasavin, E.A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1984. 13p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE85702139.

The conditions of realization of exponential and sigmoidal types of dependences of the cell survival (S) on the dose (D) are considered. It is shown that radiosensitivity of the cell is determined by enzymatic double strand breaks (eDSB) of DNA. The induction of eDSB is determined by the repair systems of the cells. The shape of survival curves with shoulder is formed by biological mechanisms realized on molecular, cellular and population levels. Quantitative analysis of the peculiarities of DNA degradation and replication has been performed. The influence of the recombinational repair on sigmoidal type of the S(D) dependence is discussed.

47393 (RERF-TR—11-83) **Inventory of ABCC-RERF autopsies Hiroshima and Nagasaki, 1948-1980.** (Radiation Effects Research Foundation, Hiroshima (Japan)). Oct 1983. 155p. (In Japanese and English). NTIS (US Sales Only), PC A08/MF A01. File Number DE85702141.

This is the fourth inventory of ABCC-RERF autopsies which covers those performed from 1948-1980 (the other three inventories). For general information the introduction of the third inventory (1948-1970) is included with some modification, and deaths and autopsy rates for 1971-1980 are added. ABCC-RERF performed 10,096 autopsies (6,555 in Hiroshima and 3,541 in Nagasaki) from 1948 to 1980. Protocols, tissues, sections, smears, etc., assembled by the collaborating institutions were examined by members of the ABCC Department of Pathology who completed ABCC records for each case. Copies of all protocols, gross tissues, and histological sections were placed in a designated repository in the

Medical School of each city where they are available to all qualified and interested investigators.

47394 **(RERF-TR—13-82) Paraquat-induced radiosensitization of mammalian cells.** Miller, R.C.; Fujikura, Toshio; Hiraoka, Toshio; Tenou, Hiromi. (Radiation Effects Research Foundation, Hiroshima (Japan)). Jun 1983. 5p. (In Japanese and English). NTIS (US Sales Only), PC A02/MF A01. File Number DE85702142.

The herbicide, paraquat (methyl viologen, 1-1' dimethy1-4, 4'-bipyridinium dichloride), stimulates the production of superoxide anion ($O_2$sup(-.)) in aerobic cells and therefore mimics some effects of ionizing radiation. In addition, concentrations of cellular glutathione are reduced by reaction with $O_2$sup(-.). It is reported here that paraquat, toxic in its own right to aerobic cells, acts as a radiosensitizer when cells are exposed to nontoxic concentrations of the drug prior to and during irradiation. The radiomimetic effect of paraquat, alone and in combination with X-rays, was examined. Paraquat affects aerated cells (hamster lung V79 cells) in a dose-dependent manner. Doses in excess of 1 mM for two hours cause significant cell killing. In combination with radiation, sublethal doses of paraquat, given for two hours prior to irradiation, enhance the lethal effects of radiation. However, if cells are exposed to the same concentration of paraquat following irradiation, no additional lethal effect is observed. Paraquat is a useful tool to study the effects of $O_2$sup(-.) and may lead to better understanding of the mechanisms of radiation-induced energy deposition in cells.

47395 **(SSI-A—84-17) Radiation protection for X-ray equipment in the 1980s.** Grapengiesser, S. (Statens Straalskyddsinstitut, Stockholm (Sweden)). Jun 1984. 14p. (In Swedish). NTIS (US Sales Only), PC A02/MF A01. File Number DE85702151.

The National Institute of Radiation Protection has decentralized the radiation protection and quality assurance of medical x-ray equipment in Sweden. It is reported on the state of control in the different regions, where central hospital services are established.

47396 **(SSI-A—84-18) Personnel dosimetry. Annual report 1983.** Kiibus, A. (Statens Straalskyddsinstitut, Stockholm (Sweden)). Jun 1984. 13p. (In Swedish). NTIS (US Sales Only), PC A02/MF A01. File Number DE85702152.

The personnel dosimetry of the (Swedish) National Institute of Radiation Protection is reported on. Doses are reported as X-ray gamma and beta-radiation, and for use in medicine, industry and research. 12% of the people monitored obtained detectable doses none had dose above occupational limits.

47397 **(UCRL—53639) Radioprotective drugs: a synopsis of current research and a proposed research plan for the Federal Emergency Management Agency. Final report.** Hickman, R.; Anspaugh, L. (Lawrence Livermore National Lab., CA (USA)). Apr 1985. Contract W-7405-ENG-48. 33p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85018053.

FEMA has broad roles in the management of disasters potentially involving substantial amounts of radioactive contamination. These could be either peacetime or wartime disasters. A meeting was held in March 1985 to see if there are any research contributions that FEMA might reasonably make in the area of radioprotective drugs that would substantially enhance its ability to perform its mission. The other federal agencies presently sponsoring research in the field were represented at the meeting. A few selected researchers also participated to provide complementary viewpoints. Activities of a modest scale that FEMA might undertake were identified, as were larger scale activities that might be undertaken in the event of long-term, major funding-level increases for FEMA. 2 refs.

47398 **Mortality among workers at the Pantex weapons facility.** Acquavella, J.F.; Wiggs, L.D.; Waxweiler, R.J.; MacDonell, D.G.; Tietjen, G.L.; Wilkinson, G.S. (Los Alamos National Lab., NM). *Health Physics;* **48**: No. 6, 735-746(Jun 1985).

The authors compared total and cause-specific mortality for workers at the Pantex nuclear weapons assembly facility employed between 1951 and 31 December 1978 with expected mortality based on US death rates. They observed significantly fewer deaths than expected from all causes of death, all cancers, digestive cancers, lung cancer, arteriosclerotic heart disease, and digestive diseases. There were no causes of death which occurred significantly more frequently than expected. Analyses of worker mortality by duration of employment, time since first employment, and radiation exposure greater than 1.00 rem produced similar results. They found no evidence that mortality from any cause of death was increased as a result of employment at Pentex.

47399 **Induction of DNA-protein crosslinks in human cells by ultraviolet and visible radiations: action spectrum.** Peak, J.G.; Peak, M.J.; Sikorski, R.S.; Jones, C.A. (Argonne National Lab., IL (USA)). *Photochemistry and Photobiology;* **41**: No. 3, 295-302(Mar 1985).

DNA-protein crosslinking was induced in cultured human P3 teratocarcinoma cells by irradiation with monochromatic radiation with wavelengths in the range 254-434 nm (far-UV, near-UV, and blue light). Wavelength 545 nm green light did not induce these crosslinks, using the method of alkaline elution of the DNA from membrane filters. The action spectrum for the formation of DNA-protein crosslinks revealed two maxima, one in the far-UV spectrum that closely coincided with the relative spectrum of DNA at 254 and 290 nm, and one in the visible light spectrum at 405 nm, which has no counterpart in the DNA spectrum. The primary events for the formation of DNA-protein crosslinks by such long-wavelength radiation probably involve photosensitizers. This dual mechanism for DNA-protein crosslink formation is in strong contrast to the single mechanism for pyrimidine dimer formation in DNA, which apparently has no component in the visible light spectrum.

## 5602 Thermal Effects

47400 **(CONF-8508116—1) Freezing of living cells.** Mazur, P. (Oak Ridge National Lab., TN (USA)). 1985. Contract AC05-84OR21400. 24p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85016297.

From 2. national summer school on cryobiology and freeze-drying; Toulbuchin, Belgaria (1 Aug 1985).

It can be calculated that a living cell will survive more than 5000 years at -196°C. This ability to essentially stop biological time has important implications in medicine and agriculture, and in biological research. In medicine the chief implications are in the banking of transplantable tissues and organs and in in vitro fertilization. In agriculture the applications stem in part from the role of frozen embryos in amplifying the number of calves produced by high quanlity cows. The problem is how can cells survive both the cooling to such very low temperatures and the return to normal temperatures. The answers involve fundamental characteristics of cells such as the permeability of their surface membranes to water and solutes. These characteristics determine whether or not cells undergo lethal internal ice formation and other response during freezing and thawing. 27 refs., 12 figs.

47401 **(BG-Trans—07073) Atmosphere at the workplace and in its environment. Assessment of the atmosphere in the range of tolerableness.** (British Gas Corp., London; Deutscher Normenausschuss (DNA), Berlin (Germany, F.R.)). [1985]. Translation of DIN 33403-Part 3, Draft, December 1984. 16p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85902066.

Guideline ranges are provided for the assessment of the atmosphere at the workplace and in the working environment for the range of tolerableness. It applies to workplaces where work is carried out regularly, and is valid for heat-acclimatized persons only without the use of special heat protection clothing.

## 5603 Chemicals Metabolism And Toxicology

*REFER ALSO TO CITATION(S) 46830, 46835, 46855, 46874, 47246, 47277, 47398*

47402 **(BNL—36800) Sulfur isotope ratios as evidence of dissolved sulfur uptake by salt marsh cordgrass.** Carlson, P.R. Jr.; Forrest, J. (Brookhaven National Lab., Upton, NY (USA); Harbor Branch Foundation, Fort Pierce, FL (USA)). Jun 1985. Contract AC02-76CH00016. 11p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85017520.

The difference in stable sulfur isotope ratios of sulfate and sulfide in marsh porewater was used to verify the uptake of hydrogen sulfide by the salt marsh cordgrass, Spartina alterniflora, in North Carlina salt marsh. Most of the plant sulfur derived from porewater sulfide was recovered as sulfate indicating that the sulfide had been oxidized within the plant. The analysis of sulfur isotope ratios of other marsh halophytes is suggested as a technique to determine whether sulfide is taken up by plants. 15 refs., 2 figs., 1 tab.

47403 **(CONF-8408169—1) Separation of glucuronide, sulfate and glutathione conjugates of benzo(a)pyrene by HPLC.** Merrick, B.A.; Selkirk, J.K. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 18p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016293.

From Symposium on the role of chemicals and radiation in the etiology of cancer; Chicago, IL, USA (26 Aug 1984).

This study reports the chromatographic properties of sulfate, glucuronide and GSH conjugates on a Dupont C-8 column by HPLC. The analytical conditions were developed with standard BaP conjugates and were utilized to chromatograph aqueous-soluble metabolites from HEF metabolism after removal of organic-soluble metabolites. 30 refs., 5 figs., 2 tabs.

47404 **(CONF-8409263—1) Correlations of acute toxicity of metal ions and the covalent/ionic character of their bonds.** Turner, J.E.; Williams, M.W.; Jacobson, K.B.; Hingerty, B.E. (Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 8p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85017094.

From Symposium of QSAR in toxicology and xenobiochemistry; Praha, Czechoslovakia (12 Sep 1984).

We have investigated correlations between physicochemical properties of 24 metal ions and their acute toxicity in mice and Drosophila. A high correlation for a softness parameter suggests that the relative covalent/ionic character of the bonds formed by the metal ions may be important in determining their toxicity. This hypothesis is reinforced by model calculations of metal binding to dinucleotides in water. Since the nature of bonds depends on ligand electronegativity, we searched for correlations involving this parameter. Although electronegativity is useful for interpreting some aspects of metal-ion behavior related to toxicity, it does not yield improved correlations. 8 refs., 3 figs., 1 tab.

47405 **(CONF-8505178—2) Tests for induction of presumed dominant-lethal effects in female mice.** Generoso, W.M.; Cain, K.T.; Hughes, L.A.; Braden, P.W. (Oak Ridge National Lab., TN (USA)). 1985. Contract AC05-84OR21400. 15p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016961.

From Collaborative study on short-term tests for genotoxicity and carcinogenicity; Cap d'Adge, France (14 May 1985).

The two carcinogens, benzo(a)pyrene (BP), and 2-acetylaminofluorene (2AAF), and their respective noncarcinogenic analogs, pyrene (PYR) and 4-acetylaminofluorene (4AAF), were tested for induction of presumed dominant-lethal effects in female mice. Each chemical was administered as a single intraperitoneal injection using the maximum dose that could be given as limited either by toxicity or solubility. The study was conducted in at least two stocks of females and the induction of presumed dominant-lethal response was determined in oocytes in maturing follicles. Among the four compounds studied, only BP induced clear-cut presumed dominant-lethal effects. In addition, it had cytotoxic effects on the oocytes resulting in marked reduction in the reproductive performance of treated females. 11 refs., 1 fig., 4 tabs.

47406 **(CONF-8506137—11) Molecular mechanisms of mutagenesis determined by the recombinant DNA technology.** Lee, W.R. (Washington Univ., Seattle (USA). Social Management of Technology Program). 1985. Contract AS05-76EV03728. 10p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016353.

From 4. international conference on environmental mutagens; Stockholm, Sweden (24 Jun 1985).

A study of the alteration of the DNA in the mutant gene can determine mechanisms of mutation by distinguishing between mutations induced by transition, transversion, frameshifts of a single base and deletions involving many base pairs. The association of a specific pattern of response with a mutagen will permit detecting mutants induced by the mutagen with a reduced background by removing mutations induced by other mechanisms from the pool of potential mutants. From analyses of studies that have been conducted, it is quite apparent that there are substantial differences among mutagens in their modes of action. Of 31 x-ray induced mutants, 20 were large deletions while only 3 showed normal Southern blots. Only one mutant produced a sub-unit polypeptide of normal molecular weight and charge in the in vivo test whereas in vitro synthesis produced a second one. In contrast, nine of thirteen EMS induced mutants produced cross-reacting proteins with sub-unit polypeptide molecular weights equivalent to wild type. Two of three ENU induced mutants recently analyzed in our laboratory produced protein with sub-unit polypeptide molecular weight and electrical charge similar to the wild type stock in which the mutants were induced. One ENU induced mutation is a large deletion. 21 refs., 1 fig.

47407 **(CONF-8506155—) Health and environmental effects of complex chemical mixtures: proceedings.** (USDOE Office of Energy Research, Washington, DC). 1985. 117p. NTIS, PC A06/MF A01; GPO Dep. File Number DE85016336.

From Health and environmental effects of complex chemical mixtures; Chicago, IL, USA (17 Jun 1985).

The Office of Health and Environmental Research (OHER) of the Department of Energy supports a broad long-term research program on human health and environmental effects from potential exposure to energy-related complex chemical mixtures. The program seeks basic mechanistic data on the effects of complex mixtures at the cellular, molecular, and whole animal levels to aid in predicting human health effects and seeks ecological data on biological and physical transformations in the mixtures, concentrations of the mixtures in various compartments of the environment, and potential routes for human exposure to these mixtures (e.g., food chain). On June 17-18, 1985, OHER held its First Annual Technical Meeting on the Complex Chemical Mixtures Program in Chicago, IL. The primary purpose of the meeting was to enable principal investigators to report the research status and accomplishments of ongoing complex chemical mixture studies supported by OHER. To help focus future research directions round table discussions were conducted.

47408 (CONF-8506155—, pp 25-32) **Evidence that high boiling coal liquids enhance the mutagenicity of aromatic amines.** Pelroy, R.A.; Stewart, D.L.; Chess, E.L. (Pacific Northwest Lab., Richland, WA). 1985. NTIS, PC A06/MF A01. File Number DE85016336.

From Health and environmental effects of complex chemical mixtures; Chicago, IL, USA (17 Jun 1985).

The combination of 6-aminochrysene (6AC) plus high boiling coal liquid appeared to be more mutagenic in the standard plate incorporation bioassay with S. typhirmurium TA 98 than either 6AC alone or coal liquid alone. Enhanced mutagenic activity was observed for all the coal liquids examined. Similar results for 6AC were obtained with the preincubation bioassay and with the microtitre fluctuation bioassay. Mutagenicity data are also given for benzo(a)pyrene (BaP) and 6-nitrochrysene. 3 tabs. (DT)

47409 (CONF-8506155—, pp 33-36) **Measurement of mutagenesis by complex mixtures in the CHO/HGPRT System: selection of parameters for optimum mutation frequency.** Cunningham, M.L.; Haugen, D.A.; Reilly, C.A. Jr. (Argonne National Lab., IL). 1985. NTIS, PC A06/MF A01. File Number DE85016336.

From Health and environmental effects of complex chemical mixtures; Chicago, IL, USA (17 Jun 1985).

The Chinese hamster ovary-hypoxanthine-guanine phosphoribosyl transferase assay has been validated for testing the mutagenic potential of numerous individual compounds. Its usefulness for testing the mutagenesis of complex mixtures is limited by the toxicity of the mixtures and by interactions that mask their true mutagenic potential. We report here modifications of the assay conditions that we found enabled us to better evaluate the toxicity and mutagenicity of complex mixtures. 2 refs., 1 fig. (DT)

47410 (CONF-8506155—, pp 37-40) **Comparative cytotoxicity of polycyclic aromatic hydrocarbons in Chinese hamster ovary cells: mechanism of and protection against cytotoxicity.** Swanson, M.S.; Haugen, D.A.; Cunningham, M.L.; Stamoudis, V.C. (Argonne National Lab., IL). 1985. NTIS, PC A06/MF A01. File Number DE85016336.

From Health and environmental effects of complex chemical mixtures; Chicago, IL, USA (17 Jun 1985).

The present study is aimed at developing and improving current approaches for using mammalian cells for meaningful measurements of the genotoxicity of mixtures of polycyclic compounds and understanding the mechanisms and significance of inhibitory interactions that occur in cellular and animal systems. Polycyclic compounds were chosen for the initial studies because of their abundance in energy-related mixtures and because of their recognized importance as energy-related carcinogens. Our results suggest that the cytotoxicity of energy-related PAH in the CHO mutagenesis assay depends primarily on metabolic conversion of the PAH to quinones. 1 tab.

47411 (CONF-8506155—, pp 41-44) **Correlation of in vitro-in vivo genotoxicity of organic compounds.** Brooks, A.L.; Mitchell, C.E. (Lovelace Inhalation Toxicology Research Institute, Albuquerque, NM). 1985. NTIS, PC A06/MF A01. File Number DE85016336. Contract AC04-76EV01013.

From Health and environmental effects of complex chemical mixtures; Chicago, IL, USA (17 Jun 1985).

To better define effective dose, studies have been conducted both in vitro and in mouse lung in vivo that evaluate the amount of DNA binding, DNA adduct formation and DNA breakage as a function of exposure level. It was observed that following enzyme activation by a range of materials (diesel exhaust extract, coal gasifier tar and B(a)P), the level of interaction with the DNA for several mutagen/carcinogens was greatly increased and that the DNA adducts formed with some chemicals remained over a long time period.

47412 (CONF-8506155—, pp 49-51) **Biological effects of chemicals in the open-ended tracheal implant model: applications to complex mixtures.** Marchok, A.C. (Oak Ridge National Lab., TN). 1985. NTIS, PC A06/MF A01. File Number DE85016336. Contract AC05-84OR21400.

From Health and environmental effects of complex chemical mixtures; Chicago, IL, USA (17 Jun 1985).

An open-ended, flow-through tracheal implant (FTTI) model was recently developed. FTTI exposed to only BAp or HCHO exhibited at most mild atypia in the cytopathology and histopathology. (DT)

47413 (CONF-8506155—, pp 53-55) **Toxicology of inhaled particles and associated organics.** Mauderly, J.L.; Bice, D.E.; Gillett, N.A.; Hanson, R.L.; Henderson, R.F.; Jones, R.K.; McClellan, R.O.; Pickrell, J.A.; Wolff, R.K. (Lovelace Inhalation Toxicology Resarch Institute, Albuquerque, NM). 1985. NTIS, PC A06/MF A01. File Number DE85016336. Contract AC04-76EV01013.

From Health and environmental effects of complex chemical mixtures; Chicago, IL, USA (17 Jun 1985).

Rats were repeatedly exposed by inhalation to a variety of energy related products for a major portion of their life span and were evaluated for effects using assays of respiratory function, pulmonary defense mechanisms, biochemistry, histopathology, cytokinetics, and morphometry. (DT)

47414 (CONF-8506155—, pp 57-58) **Effects of inhalation exposure to SRC-II heavy distillate.** Springer, D.L.; Sasser, L.B.; Zangar, R.C.; Mahlum, D.D. (Pacific Northwest Lab., Richland, WA). 1985. NTIS, PC A06/MF A01. File Number DE85016336.

From Health and environmental effects of complex chemical mixtures; Chicago, IL, USA (17 Jun 1985).

Rats and mice were exposed to inhalation of SRC-II heavy distillate (HD: boiling range 550 to 850°F) for 6 hours/day, 5 days/week, at a dose of 0.7, 0.14, 0.03 or 0.0 mg HD/L of air for either 1, 4 or 12 weeks and observed for the remainder of their lifespans. Results indicate that both growth and median survival age were decreased for rats and mice. (DT)

47415 (CONF-8506155—, pp 63-65) **Health effects of complex mixtures.** Renne, R.A.; Buschbom, R.L. (Battelle Pacific Northwest Lab., Richland, WA). 1985. NTIS, PC A06/MF A01. File Number DE85016336.

From Health and environmental effects of complex chemical mixtures; Chicago, IL, USA (17 Jun 1985).

The acute and chronic toxic effects of dermal exposure in mice to selected crude materials and chemical or distillate fractions from synthetic fossil fuel technologies are reported. Data indicated that the heavy distillate (HD) from the SRC-II technology was a potent dermal carcinogen and that the basic tar, neutral tar, and polycyclic aromatic hydrocarbon (PAH) fractions were the most carcinogenically potent solvent fractions of HD. Assay of recombined PAH and basic fractions did not indicate an increase in carcinogenicity compared with the PAH fraction alone. Assay of nitrosated basic tar fraction of HD had no effect on its carcinogenicity. (DT)

47416 (CONF-8506155—, pp 67-70) **Toxicologic interaction of neutral components of a coal gasification tar as measured by their mouse dermal tumor-initiating activity.** Swanson, M.S.; Haugen, D.A.; Kirchner, F.R.; Reilly, C.A. Jr. (Argonne National Lab., IL). 1985. NTIS, PC A06/MF A01. File Number DE85016336.

From Health and environmental effects of complex chemical mixtures; Chicago, IL, USA (17 Jun 1985).

The purpose of this study is to better define toxicologic interactions between major classes of the neutral fraction of coal gasifier tar by using a dermal initiation-promotion model to obtain results amenable to interpretation. Thus the tumor-initiating activities of the aliphatic/aromatic hydrocarbons and of the polar neutral components are reported. 1 fig., 1 tab. (DT)

47417 (CONF-8506155—, pp 71-74) **Factors influencing skin tumor initiating activity of complex mixtures.** Mahlum, D.D.; Wright, C.W.; Later, D.W.; Wilson, B.W. (Pacific Northwest Lab., Richland, WA). 1985. NTIS, PC A06/MF A01. File Number DE85016336. Contract AC06-76RL01830.

From Health and environmental effects of complex chemical mixtures; Chicago, IL, USA (17 Jun 1985).

Shale oil distillates boiling from ambient -650°, 650 to 700°, 700 to 750°, and >750° were tested for their tumor initiating activity. We examined the effect of different boiling range distillates on the initiating activity of BaP by applying the BaP (25 $\mu$g) in methylene chloride containing 5 mg of the test distillate. The results show that the 300 to 700°F distillate inhibited the expression slightly while the 700 to 750°, the 750 to 800°, and the 800 to 850°F distillates produced marked depression in the tumor initiating activity of BaP. (DT)

47418 (CONF-8506155—, pp 75-78) **Bladder tumors resulting from dermal exposure to aromatic amines.** Reilly, C.A. Jr.; Pahnke, V.A. Jr.; Kirchner, F.R.; Duggal, K.; Fritz, T.E. (Argonne National Lab., IL). 1985. NTIS, PC A06/MF A01. File Number DE85016336.

From Health and environmental effects of complex chemical mixtures; Chicago, IL, USA (17 Jun 1985).

This study has demonstrated that dermal exposure to an aromatic amine can result in the induction of bladder tumors. Although no bladder tumors were seen in animals treated with the base fraction of the coal gasification tar, the dose of any single aromatic amine in that mixture was significantly lower than that for any of the other amine treatment groups. The results support the potential of coal-derived materials as bladder carcinogens. 1 ref., 1 tab. (DT)

47419 (CONF-8506155—, pp 79-82) **Promotion of preneoplastic changes in liver by coal-derived organic mixtures applied to skin.** Reilly, C.A. Jr.; Peraino, C.; Haugen, D.A.; Mahlum, D.D.; Springer, D.L. (Argonne National Lab., IL; Battelle Pacific Northwest Lab., Richland, WA). 1985. NTIS, PC A06/MF A01. File Number DE85016336.

From Health and environmental effects of complex chemical mixtures; Chicago, IL, USA (17 Jun 1985).

Potent tumor initiators have been identified in energy-related mixtures. The purpose of the present study is to assess the tumor-promoting activities of energy-related mixtures in a system in which initiating and promoting activities can be clearly distinguished. The results suggest a major contributor to tumorigenic risk from fossil-fuel-derived mixtures is their systemic promoting activity, such systemic effects can result from skin exposure to the mixtures. 1 tab. (DT)

47420 (CONF-8506155—, pp 87-92) **Molecular dosimetry: technical development, skin and transplacental exposure.** Shugart, L. (Oak Ridge National Lab., TN). 1985. NTIS, PC A06/MF A01. File Number DE85016336. Contract AC05-84OR21400.

From Health and environmental effects of complex chemical mixtures; Chicago, IL, USA (17 Jun 1985).

We have demonstrated a new alternative analytical method for the analysis, of BaP binding to DNA. Essentially, the technique consists of the facile removal, by acid hydrolysis, of BaPDE-adduct from DNA or protein, as the free tetrols which are then separated and quantitated by fluorescence/HPLC. The technique not only allows femtomole amounts of BaPDE associated with DNA from a single mouse skin to be detected using conventional instrumentation, but also establishes the stereochemical origin of the adduct. As a result we have successfully used this technique to evaluate not only BaPDE-DNA adduct formation in the whole mouse, but also the responsiveness of mouse skin in organ culture as a suitable biological system for screening potential chemical carcinogens. (DT)

47421 (CONF-8506155—, pp 93-96) **Skin metabolism in percutaneous absorption: new approaches and concepts.** Kao, J.Y. (Oak Ridge National Lab., TN). 1985. NTIS, PC A06/MF A01. File Number DE85016336. Contract AC05-84OR21400.

From Health and environmental effects of complex chemical mixtures; Chicago, IL, USA (17 Jun 1985).

We have developed in vitro approaches to study the percutaneous penetration of chemicals in metabolically viable and structurally intact mammalian skin. Studies using these culture systems with model compounds such as benzo(a)pyrene and testosterone have shown that in all species studied, including man, the metabolic viability of the tissue was a major determinant in the vitro skin permeation of surface-applied chemicals. Permeation was accompanied by extensive cutaneous "first pass" metabolism; both parent compounds and a full spectrum of metabolites were found in the culture medium from viable skin preparations. However, in previously frozen nonviable skin preparations, essentially only unchanged parent compounds were detected in the receptor fluid. (DT)

47422 (CONF-8506155—, pp 97-98) **Metabolism and DNA binding of BaP in the presence of complex mixtures.** Springer, D.L.; Wilson, B.W.; Schirmer, R.E.; Later, D.W.; Mahlum, D.D. (Pacific Northwest Lab., Richland, WA). 1985. NTIS, PC A06/MF A01. File Number DE85016336. Contract AC06-76RL01830.

From Health and environmental effects of complex chemical mixtures; Chicago, IL, USA (17 Jun 1985).

The purpose of the present study was to determine the degree of DNA binding and the metabolism of a marker compound (BaP) in the presence of the 800 to 850°F (CL-1) and the >850°F (CL-2) distillates from the solvent refined coal (SRC-II) process. When radio-labelled BaP was applied to mouse skin in the presence of CL-1 or CL-2 (50 μg BaP and 25 mg CL), binding to DNA in the presence of CL was negligible. When the amount of CL was reduced to 500 μg, the binding of BaP to DNA was reduced by 77 and 68%, respectively for CL-1 and CL-2, relative to the binding of BaP (50 μg) alone; there were no significant differences in BaP binding between the CL. (DT)

47423 (CONF-8506155—, pp 99-101) **Effective dose of inhaled complex mixtures.** Bond, J.A.; Sun, J.D.; Mitchell, C.E.; Wolff, R.K.; McClellan, R.O. (Lovelace Inhalation Toxicology Research Institute, Albuquerque, NM). 1985. NTIS, PC A06/MF A01. File Number DE85016336. Contract AC04-76EV01013.

From Health and environmental effects of complex chemical mixtures; Chicago, IL, USA (17 Jun 1985).

The results referenced here clearly show that particle association of benzopyrene, 1-nitropyrene, 2-aminoanthracene and phenanthridone influences the rate of clearance of those chemicals. The data predict that under some conditions (e.g., particle association) lungs can accumulate significant quantities of inhaled chemicals. In addition, the data demonstrate that lungs and nasal tissue can metabolize inhaled chemicals to several biologically active metabolites. (DT)

47424 (CONF-8506155—, pp 103-105) **Toxicokinetics of complex mixtures.** Witschi, H.P.; Smith, L.H. (Oak Ridge National Lab., TN). 1985. NTIS, PC A06/MF A01. File Number DE85016336. Contract AC05-84OR21400.

From Health and environmental effects of complex chemical mixtures; Chicago, IL, USA (17 Jun 1985).

Fuel oil blend No. 931, which produces within one year a 100% incidence of skin tumors in C3H mice, and the same fuel oil blend following low severity hydrotreatment (to 2650 ppM N) which has no carcinogenic activity were spiked with $^{14}C$-labelled dotriacontane and painted onto the skin of mice. Radioactivity in blood rose steadily over the entire 24 hour period. In animals exposed to the non-carcinogenic mixture, diffusion of the marker substance into blood occurred more rapidly than in the animals painted with the carcinogenic oil. Accumulation of label in internal organs followed a similar pattern. (DT)

47425 (CONF-8508109—1) **Surveillance of employees involved in coal-derived materials research with emphasis on the dermatologic portion of the surveillance.** Garrett, A.S. Jr. (Oak Ridge National Lab., TN (USA)). 1985. Contract AC05-84OR21400. 9p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85017304.

From Canadian Medical Association annual meeting; Ottawa, Canada (21 Aug 1985).

Special surveillance of employees involved in coal-derived materials research was begun in February, 1975. These evaluations were in addition to the basic medical surveillance of all employees at ORNL. Included in this health assessment are laboratory studies every 18 months of all employees followed by a physical exam by a physician or P.A. for employees 45 years and older. Physician exams are performed every 36 months for employees under age 45. This presentation covers the details and findings of the special skin surveillance program. 3 refs.

47426 (LA-UR—85-2553) **Translocation of particles to the pleural space and tracheobronchial lymph nodes following lung deposition.** Lehnert, B.E.; Valdez, Y.E.; Hyler, S. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 32p. (CONF-8509138—1). NTIS, PC A03/MF A01; GPO Dep. File Number DE85015695.

From 6. international symposium on inhaled particles; Cambridge, MA, USA (1 Sep 1985).

The translocation of particles from the alveolar compartment to the pleural space and tracheobronchial lymph nodes was investigated in rats over a 30 day period following the intrapulmonary instillation of 4 x $10^8$ polystyrene microspheres (1.9 μm dia.). In ini-

tial studies, ≃$10^4$ particles were found in the pleural space compartment on Days 1, 14 and 30 after particle deposition, and most of these were cell-associated. Subsequent pleural space studies indicated, however, that the particles found in this compartment were, at least in part, due to the pleural lavage technique, and, unlike observations reported for some fibers, the translocation of the particles used in our study to the pleural space does not represent an important lung clearance pathway. In regard to particle clearance to the tracheobronchial lymph nodes, the accumulation of particles, most of which were extracellular, kinetically was biphasic with the most rapid phase occurring within the first 24 hours. Over the Day 1-30 period, the numbers of particles in the lymph nodes increased linearly to ≃1.2 x $10^8$ microspheres. The percentages of the nodal particles that were associated with nodal mononuclear phagocytes (NMP) over the course of the study were inversely proportional to nodal particulate burdens, even though the percentage of cells with engulfed particles increased; the percentage of NMP asymptotically approached a maximum value over the range of nodal burden of 6-12 x $10^8$ particles. The distributions of the microspheres in the NMP were essentially identical on Days 1, 14, and 30. Major differences in the distributions of particles in lavage alveolar macrophages and NMP were not consistent with the notion that the latter represented translocated AM. 20 refs., 7 figs., 4 tabs.

47427 **(LA-UR—85-2944) Characterization of metal binding peptides from cadmium resistant plant cells.** Robinson, N.J.; Barton, K.; Naranjo, C.M.; Sillerud, L.O.; Trewhella, J.; Watt, K.; Jackson, P.J. (Los Alamos National Lab., NM (USA); Agracetus Corp., Middleton, WI (USA); Cetus Corp., Emeryville, CA (USA)). 1985. Contract W-7405-ENG-36. 6p. (CONF-8508108—2). NTIS, PC A02/MF A01; GPO Dep. File Number DE85017546.

From 2. international meeting on metallonthionein; Zurich, Switzerland (21 Aug 1985).

The majority of the cellular cadmium (<80%) in cadmium resistant Datura innoxia cells is bound to a small, metal induced peptide which is not metallothionein. This peptide consists of glutamate, cysteine and glycine in a ratio between 2:2:1 and 3:3:1 and has an apparent molecular weight of 776, under denaturing conditions. It is heat stable and complexes with cadmium to produce multimeric forms which are separable by gel filtration. Chemical analyses suggest that some amino acids are not joined by classical peptide linkages. This indicates that the synthesis of the peptide may not be directed by mRNA and that induction of its synthesis may not involve increased transcription from a putative gene corresponding directly to this peptide. A smaller proportion (>15%) of the cellular cadmium is bound to a larger compound which is also heat stable and binds copper more readily than cadmium in vivo. This larger compound has an amino acid composition similar, in some respects, to metallothioneins. 22 refs., 1 fig., 1 tab.

47428 **(SRD-R—310) Assessment of individual and societal risks.** Considine, M. (UKAEA Safety and Reliability Directorate, Culcheth). Oct 1984. 23p. United Kingdom Atonic Energy Authority, Wigshaw Lane, Culcheth, Warrington, England. File Number TI85901919.

This report discusses the meaning of individual and societal risk, how such values can be numerically determined and how they can be applied in decision making. Section 1 describes the various ways of expressing numerical risk levels and the various strengths and weaknesses of each form of expression. Section 2 derives expressions and describes the methodology for determining individual and societal risks from flammable releases considering both immediate ignition at source and delayed ignition of a drifting cloud. The methodology is deliberately set out to facilitate its incorporation into a computer code at some future data. Section 3 briefly describes the current and future work on numerical values for the parameters to be used in risk expressions. 24 refs., 2 figs.

47429 **(UCRL—92130) Toxicologic strategy for mutagens formed in foods during cooking: status and needs.** Hatch, F.T.; Felton, J.S. (Lawrence Livermore National Lab., CA (USA)). 14 Aug 1985. Contract W-7405-ENG-48. 24p. (CONF-8506137—12). NTIS, PC A02/MF A01; GPO Dep. File Number DE85017399.

From 4. international conference on environmental mutagens; Stockholm, Sweden (24 Jun 1985).

This article presents a strategy appropriate to reach an evaluation of the potential health hazard from the consumption of cooked and heat processed foods. The view is based on nearly seven years of experience in a multidisciplinary project sponsored by the National Institute of Environmental Health Sciences/National Toxicology Program at the Lawrence Livermore National Laboratory. The formation and genetic toxicity of mutagens formed during the cooking of meats, primarily beef, under usual household conditions is a prime focus of the discussion. 31 refs., 2 figs., 8 tabs.

47430 **Activation of mutagens in cooked ground beef by human-liver microsomes.** Felton, J.S.; Healy, S.K. (Lawrence Livermore National Lab., CA). *Mutation Research;* **140**: 61-65(1984). Contract W-7405-ENG-48.

The total organic base fraction purified from fried ground beef is metabolized by human-liver microsomes to form mutagens detectable by the Ames/Salmonella bacterial assay. The mutagens produced have an absolute requirement for metabolic activation; without it, no increase in the number of revertants over background is seen. Microsomes from human liver activate the mutagens significantly more than microsomes from uninduced mouse or rat liver; the microsomes from one individual were nearly as active as those of Aroclor-induced mice and rats. α-Naphthoflavone (ANF) inhibits activation of these mutagenic bases, implying that the metabolism is mediated by the inducible form(s) of cytochrome P-448. Thus, the human liver has the potential to metabolize the cooked beef mutagen(s) to active intermediates, posing a possible mutagenic risk. However, unlike the animal metabolizing system, which needs to be artificially induced, the human system appears to be naturally induced through diet or environmental exposure. 30 references, 2 figures.

47431 **Results of health and environmental studies.** Cowser, K.E. (Oak Ridge National Laboratory, Oak Ridge, TN). pp 580 of Synthetic fossil fuel technologies. Results of health and environmental studies. Cowser, K.E. Boston, MA; Butterworth Publishers (1982). (CONF-821048—).

From 5. Life Sciences symposium on synthetic fossil fuel technologies; Gatlinburg, TN, USA (24 Oct 1982).

An extensive program of research on the health and environmental consequences associated with advanced fossil energy technologies has been conducted since our first life sciences symposium in 1978. In particular, a considerable data base on the toxicological properties of synthetic fossil fuels and on the transport, fate, and effects of residuals occurring during the production of these materials has evolved. The purpose of the Fifth Life Sciences Symposium, Synthetic Fossil Fuel Technologies: Results of Health and Environmental Studies, was to review the present state of knowledge, uncertainties, and future research requirements of these technologies and thereby assist in the development of environmentally acceptable fossil energy processes. To achieve this objective, scientists and engineers from government, industry, universities, and national laboratories were invited to present their most recent experimental findings. Ample time was provided for debate. Also, a special panel of government and industry officials considered the need and opportunities for future research. It was within such a multidisciplinary setting that participants representing thirty-eight organizations explored the solution to presently identified problems and considered the longer-term issues related to technology development. This book provides a compilation of the principal research findings and interpretations for the scientists, engineers, and interested public, as well as identifies the requirements for additional research.

## 5604 Other Environmental Pollutant Effects

47432 **(AD-A—154567/2/XAB) Practical question-and-answer guide on VDTS (video display terminals) for BEES (base bioenvironmental engineer). Final report.** Olson, B.M. (Air Force Occupational and Environmental Health Lab., Brooks AFB, TX (USA)). 1 Jan 1985. 15p. NTIS, PC A02/MF A01.

The USAF OEHL conducted an extensive literature review of Video Display Terminals (VDTs) and the health problems commonly associated with them. The report is presented in a question-

and-answer format in an attempt to paraphrase the most commonly asked questions about VDTs that are forwarded to USAF OEHL/RZN. The questions and answers have been divided into several topic areas: Ionizing Radiation; Nonionizing Radiation; Optical Radiation; Ultrasound; Static Electricity; Health Complaints/Ergonomics; Pregnancy.

47433 **(EPRI-EA—4218) Extra-high voltage transmission lines: mechanisms of biological effects on honeybees. Final report.** Greenberg, B.; Bindokas, V. (Bioconcern, Inc., Chicago, IL (USA)). Aug 1985. 90p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI85920861.

The authors confirmed that bee exposure to E fields, including 100 kV/m, under the dry conditions cause no detectable effect on colony behavior. If, however, exposure occurs when moisture is present, or if bees are on a conductive surface, they become visibly disturbed, mortality is increased, abnormal propolization occurs, and colony development may be impaired. It seems plausible that bees on conductive surfaces within a hive under a 765-kV/m transmission line can perceive shocks from body currents induced by enhanced intra-hive E fields. Hives exposed under a 765-kV/m transmission line to an ambient E field of 7 kV/m have internal step-potential-induced currents and interchamber chort-circuit currents which range from one-half to several microamperes. Total hive currents can exceed 100 μA. Thus, induced hive currents exceed the empirical sting threshold by up to a factor of 100 and the E-field-induced body current by up to a factor of 1000. The degree of disturbance which could be produced by these intra-hive currents will eclipse that produced by perception of E-field-induced body currents. The authors therefore attribute the disturbance of colonies under a transmission line primarily to electric shock from induced hive currents. 10 refs., 51 figs., 18 tabs. (DT)

47434 **(PB—85-200871/XAB) Biological effects of 60-Hz power transmission lines.** Graves, H.B.; Bracken, T.D.; Griffin, J.; de Lorge, J.; Granger Morgan, M. (Pennsylvania State Univ., University Park (USA)). Mar 1985. 278p. NTIS, PC A13/MF A01.

Sponsored by Florida State Dept. of Environmental Regulation, Tallahassee.

This report was prepared by the Florida Electric and Magnetic Fields Science Advisory Commission for submittal to the Department of Environmental Regulation (DER). This report is essentially a literature review on the biological effects of large transmission lines.

# 57 HEALTH AND SAFETY

*REFER ALSO TO CITATION(S) 46222, 46473, 47401, 47425*

47435 **(EPRI-EA—4171) Input-output analysis of occupational health risks in electric power generation. Final report.** Yokell, M.D. (Energy and Resource Consultants, Inc., Boulder, CO (USA)). Jul 1985. 51p. Research Reports Center, Box 50490, Palo Alto, CA 94303. File Number TI85920846.

The use of input-output analysis, in conjunction with occupational safety and health statistics, is a viable method of screening energy technologies for occupational safety and health impacts. The method developed here achieved results well within the range of more detailed, process analytic techniques. The input-output technique has the advantage that it can be used cost effectively - relative to more detailed methods such as the process approach - to screen a large number of energy technologies rapidly and with a minimum of computer costs. 25 refs., 7 tabs. (DT)

47436 **(LITH-IKP-R—367) Reliability theory and its applications.** Bergman, B. (Linkoeping Inst. of Tech. (Sweden). Dept. of Mechanical Engineering). Oct 1984. 84p. (CONF-8406271—1). NTIS (US Sales Only), PC A05/MF A01. File Number DE85752522.

From 10. Nordic conference on mathematical statistics; Bolkesjo, Norway (19 Jun 1984).

In this expository paper some results in reliability theory and their usefulness in industrial applications are discussed. First, some methods for the analysis of system reliability are reviewed. Then we discuss some methods applicable to the assessment of component reliability: Bayesian methods as well as stress-strenght analyses and safety analysis of oneshot devices are discussed. Finally, we discuss some aspects on maintained systems including also a treatment of the modelling of software system reliability growth.

47437 **(SAND—85-1700) Hazards in high pressure systems.** Priddy, T.G. (Sandia National Labs., Albuquerque, NM (USA)). Aug 1985. Contract AC04-76DP00789. 13p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85015490.

The High Pressure Systems Committee (HPSC) of the American Society of Mechanical Engineers is writing a set of rules and guides which will eventually be approved for treatment of safety concerns in high pressure operations. An introductory section of the proposed standard is being written to describe the hazards in high pressure. This paper is an edited version of the early draft of that section which is numbered 2000. Taking Section 2000 out of context (separately printing it from the remainder of the proposed standard) poses a possible misunderstanding in that high pressure is not necessarily synonymous with a lack of safety. There are many high pressure systems in operation with very acceptable safety records. However, when the potential for damage is great, it becomes more essential that safety be comprehensively engineered and practiced. Everyone concerned should be aware to some degree of the dangers that could happen in such operations. This paper is written in an attempt to share the concerns (appraisal of the risks) that members of the HPSC have for high pressure as interpreted and edited by this author. 22 refs.

47438 **(BG-Trans—07140) Assessment of the effect of mechanical vibrations on human beings. Part 1. Measurement and evaluation of vibration transmitted to the hand-arm-system. Part 2. Hand-held chain sawing machines. Part 3. Brush cutters powered by I.C. engine.** (British Gas Corp., London). 18 Jun 1985. Translation of Draft standard DIN45, 675-Parts, 1, 2 and 3, Oct 1984. 29p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85902064.

By means of the method for measurement described in this Standard, measuring results can be obtained for the assessment of the vibratory stress on human beings transmitted to the hand-arm-system. It is the object of the specifications to obtain comparable and reproducible and consequently characteristic-quantities for the assessment of the vibratory stress. The method of measurement serves for the determination of measured values on an appliance and may also be used for a comparison of appliances. It also serves for the determination of the vibratory stress transmitted to the hand-arm-system at the individual working place. 7 figs., 3 tabs.

# 58 GEOSCIENCES

## 5801 Geology And Hydrology

*REFER ALSO TO CITATION(S) 46031, 46190, 46193, 46197, 47252*

47439 **(DOE/ER/60197—6) Surging as a potential response of ice sheets to $CO_2$-induced changes in the polar environment (SPICAE). Progress report, September 1984-August 1985.** Radok, U. (Colorado Univ., Boulder (USA). Cooperative Inst. for Research in Environmental Sciences). Aug 1985. Contract AC02-84ER60197. 26p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85017431.

A numerical flow-band model of a polar ice stream that includes dynamic interaction with a floating ice shelf has been developed. The model includes a basal sliding relationship that is calibrated by assuming that the future sliding behavior of the ice stream will be analogous to its present sliding behavior. The model can be used to simulate the response of an ice stream to changes in back pressure from an ice shelf, changes in the accumulation rate or changes in sea level. 5 figs. (ACR)

47440 **(INIS-mf—9761) Model calculations of the groundwater conditions along a profile at Forsmark.** Axelsson, C.; Carlsson, L. (Sveriges Geologiska Undersoekning, Uppsala). May 1981. 51p. (In Swedish). NTIS (US Sales Only), PC A04/MF A01. File Number DE85781605.

The scope of the calculations was to determine which influence the Singoe fracture zone and the hydraulic conductivity of the sediment deposits on the sea bed could have on groundwater conditions in the bedrock at the site of the planned repository. The bedrock of the Forsmark area consists of gneiss granite, with two major fracture zones crossing the area. The sediment deposit consists of sandy, silty clay. The groundwater conditions have been investigated along a profile with a length of 10 km and a depth of 2 km. The effects of the variations in hydraulic conductivity of the sediment deposits above the fracture zone are described. The minimum values of groundwater potential and mean gradients above planned repository are found when the fracture zone is more pervious than the rock mass. The models are presented in graphs and tables. (G.B.).

47441 (INIS-SU—299, pp 121) **Program to study Precambrian basement rocks in the midcontinent region, USA.** Bickford, M.E.; Schmus, W.R. van (Kansas Univ., Lawrence (USA). Dept. of Geology). 1984. NTIS (US Sales Only), PC A17/MF A01. File Number DE85781599. (CONF-840820—Vol.9-Pt.1-Summs.).

From 27. international geological congress; Moscow, USSR (4 Aug 1984).

Short note.

47442 (INIS-SU—299, pp 164) **Early Proterozoic orogenic provinces in the central United States.** Schmus, W.R. van; Bickford, M.E. (Kansas Univ., Lawrence (USA). Dept. of Geology). 1984. NTIS (US Sales Only), PC A17/MF A01. File Number DE85781599. (CONF-840820—Vol.9-Pt.1-Summs.).

From 27. international geological congress; Moscow, USSR (4 Aug 1984).

Short note.

47443 (INIS-SU—299, pp 93) **Nd-isotopes and continental lithospheric evolution.** Basu, A.R. (Rochester Univ., NY (USA)). 1984. NTIS (US Sales Only), PC A17/MF A01. File Number DE85781599. (CONF-840820—Vol.9-Pt.1-Summs.).

From 27. international geological congress; Moscow, USSR (4 Aug 1984).

Short note.

47444 (INIS-SU—299, pp 99-100) **Constraints on chemical depletion of the upper mantle.** Hofmann, A.W. (Max-Planck-Institut fuer Chemie (Otto-Hahn-Institut), Mainz (Germany, F.R.)). 1984. NTIS (US Sales Only), PC A17/MF A01. File Number DE85781599. (CONF-840820—Vol.9-Pt.1-Summs.).

From 27. international geological congress; Moscow, USSR (4 Aug 1984).

Short note.

47445 **(INIS-SU—299) 27. International geological congress. Vol. 9. Part 1. Summaries of reports.** (AN SSSR, Moscow. Inst. Litosfery). 1984. 387p. (CONF-840820—Vol.9-Pt.1-Summs.). NTIS (US Sales Only), PC A17/MF A01. File Number DE85781599.

From 27. international geological congress; Moscow, USSR (4 Aug 1984).

Short note.

Items within the scope of EDB have been entered individually into the data base. (ACR)

47446 **(NP—5752652) Marine geophysical survey of the continental shelf of East Greenland 60N - 71N. Project DANA 79. Preliminary report.** Larsen, B. (Groenlands Geologiske Undersoegelse, Copenhagen (Denmark)). Oct 1980. 34p. Groenlands Geologiske Undersoegelse, Copenhagen (Denmark).

EM-2.

The Geological Survey of Greenland have aboard M/V DANA concluded the following geophysical surveys: 1 day in Cattegat for 'Fredningsstyrelsen'; 14 days around the Faroes for the Geological Survey of Denmark and 'Faeroeernes Landsstyre'; 45 days' survey of the shelf of East Greenland between 60sup(o)N and 71sup(o)30'N. Due to unusual good weather and ice conditions, combined with good performance of the survey instruments the cruise was extremely successful. The boundary between the basalts and the sediments was mapped in outline around two thirds of the circumference of the Faeroe shelf - and the structure of the covering sediments recorded. In East Greenland the western boundary of the sediment basin was mapped for a distance of approximately 1200 km.

47447 **Anisotropy in the Ironton and Galesville sandstones near a thermal-energy-storage well, St. Paul, Minnesota.** Miller, R.T. (Geological Survey, St. Paul, MN). *Ground Water;* **22**: No. 5, 532-537(Sep-Oct 1984). Contract AC06-76RL01830.

The US Geological Survey is studying the potential for storage of heated water in a sandstone aquifer in St. Paul, Minnesota. The efficiency of the aquifer to store thermal energy is related, in part, to the hydrogeologic characteristics of the aquifer. The movement of heat away from the injection well is directly related to the anisotropy. Aquifer tests were conducted to determine the anisotropy near the heated-water injection well. The maximum and minimum values of transmissivity along the principal directions of the hydraulic conductivity tensors of the Ironton and Galesville Sandstones in St. Paul, Minnesota are approximately 1090 and 480 feet squared per day. The storage coefficient is 0.000045. These values represent the average of four determinations of nonsteady flow to a well in a idealized infinite anisotropic aquifer. Analysis of the values of transmissivity and storage coefficient for hypothetical changes in location of two of the monitoring wells where depth-deviation surveys were not available indicates that computed transmissivities vary less than +/-5% and storage coefficients vary less than +/-6%. 5 references, 5 figures, 3 tables.

## 5802 Geophysics

*REFER ALSO TO CITATION(S) 47446*

47448 **(EGG-M—09985) 1983 Borah Peak, Idaho earthquake: a review of seismicity, surface faulting and regional tectonics.** Richins, W.D. (EG and G Idaho, Inc., Idaho Falls (USA)). 1985. Contract AC07-76ID01570. 9p. (CONF-8510118—4). NTIS, PC A02. File Number DE85017474.

From DOE natural phenomena hazards mitigation conference; Las Vegas, NV, USA (7 Oct 1985).

The October 28, 1983 Borah Peak, Idaho earthquake (M/sub s/ = 7.3) occurred in an area of low historic seismicity within east-central Idaho along a segment of the Lost River fault active during the Holocene. A dense network of portable short period seismographs (up to 45 stations, station spacings of 2 to 10 km) was installed beginning several hours after the main shock and operated for 22 days. In addition to records from the portable instrumentation, data from permanent seismograph stations operating in Idaho, Utah, Montana, Oregon, Washington, and Wyoming, provide a good regional data base. No foreshock activity above magnitude 2.0 (M/sub L/) was detected for the two month period preceding the main shock. The distribution of 421 aftershocks of M/sub L/ > 2 defines an epicentral pattern, 75 km x 15 km, trending north-northwest parallel to the surface rupture but displaced laterally southwest by 5 to 10 km. The epicenter of the main shock is approximately 14 km south-southwest of the end of surface faulting. This relationship suggests unilateral rupture propagating to the northwest. Aftershocks extend to depths of approximately 16 km and in the southeastern portion of the aftershock pattern define a zone, dipping approximately 45° SW, that intersects the surface near the fault scarp. The entire aftershock zone as observed during the first 3.5 weeks was active shortly after the main shock occurred. Fault plane solutions indicate predominantly normal faulting with varying components of strike slip. 17 refs., 8 figs. 1 tab.

47449 **(INIS-mf—9358) Data catalogue of earthquakes in the Federal Republic of Germany and adjacent areas 1979.** Henger, M.; Leydecker, G.; Wendt, M. (eds.). (Seismologisches Zentralobservatorium Graefenberg, Erlangen (Germany, F.R.); Bundesanstalt fuer Geowissenschaften und Rohstoffe, Hannover (Germany, F.R.)). 1981. 110p. NTIS (US Sales Only), PC A06/MF A01. File Number DE85781603.

The Seismological Data Catalogue is a continuation of the 'Seismological Bulletin' published annually by the Seismological Central Observatory Graefenberg between 1969 and 1974. This Data Catalogue is a further contribution to the completion of the series which started in 1980 with the edition of the catalogues for 1975 and 1978. The data of this catalogue are based on a station data file which has been compiled from seismogram readings reported by the German stations and institutions.

47450 **(INIS-mf—9359) Data catalogue of earthquakes in the Federal Republic of Germany and adjacent areas 1980.** Henger, M.; Leydecker, G. (eds.). (Seismologisches Zentralobservatorium Graefenberg, Erlangen (Germany, F.R.); Bundesanstalt fuer Geowissenschaften und Rohstoffe, Hannover (Germany, F.R.)). 1983. 127p. NTIS (US Sales Only), PC A07/MF A01. File Number DE85781604.

The Seismological Data Catalogue is a continuation of the 'Seismological Bulletin', published annually by the Seismological Central Observatory Graefenberg between 1969 and 1974. The new series differs from the Bulletin in that it contains no data from teleseismic events but is restricted to local and regional earthquakes. The data in this catalogue are based on a station data file compiled from seismogram readings reported by the German stations and institutions listed. Also included are epicenter data from international agencies and European seismological institutes. In general the catalogue contains data from earthquakes within the area between 55 N and 46.5 N and between 5 E and 16 E. It was agreed with the reporting seismic stations to include only events with magnitudes equal to or greater than ML=2.0. Exceptions to this rule may be made if the epicenter of an earthquake is located in an area of low seismic activity or if an event within the Federal Republic of Germany has already been reported by another agency. (orig./HP).

47451 **(NUREG/CR—4339) Review of recent research on the seismotectonic of the Southeastern Seaboard and an evaluation of hypotheses on the source of the 1886 Charleston, SC, earthquake.** Dewey, J.W. (Geological Survey, Denver, CO (USA)). Aug 1985. 55p. NTIS, PC A04/MF A01 - GPO. File Number TI85902149.

In spite of extensive research on the source of the 1886 Charleston, SC, earthquke, there is not yet a consensus among earth scientists on the characteristics of the fault that produced the earthquake or on the likelihood of future large earthquakes at other locations of the Southeastern Seaboard. This report reviews the evidence from recent research on three categories of hypothesis: (1) hypotheses on the specific geologic structures that might cause large earthquakes in the Southeastern Seaboard; (2) hypotheses on the seismotectonic zones in which large earthquakes might occur; and (3) hypotheses on temporal variations of seismicity in the Southeastern Seaboard. Hypotheses that are representative of each category are summarized, and evidence for and against each hypothesis is given, if such evidence is available. When data are interpreted in the ways that currently seem to be the most straightforward, the hypotheses that are supported by one kind of evidence are usually opposed by another kind of evidence. Reaching a consensus on the cause of the Charleston earthquake, and on the likelihood of such an earthquake occurring at other locations of the Southeastern Seaboard, will therefore probably require the reconciliation of what currently appear to be contrary pieces of evidence. In addition, most of the individual hypotheses do not predict that large Southeastern Seaboard earthquakes will occur only in a small region near Charleston. The ability to define small source regions in the Southeastern Seaboard may require simultaneous consensus on the specific geologic structures capable of causing large earthquakes, on the broader seismotectonic zone within which conditions are favorably for eventual activation of the specific structures, and on the temporal variations of seismicity in small source regions. 73 refs., 10 figs.

47452 **(UCRL—92423) Interpreting geological structure using kriging.** Mao, N. (Lawrence Livermore National Lab., CA (USA)). Jul 1985. Contract W-7405-ENG-48. 11p. (CONF-851054—3). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85016439.

From Society of Mining Engineers fall meeting; Albuquerque, NM, USA (16 Oct 1985).

We applied kriging (geostatistics) to interpret the structure of basement rock in Yucca Flat, NTS from borehole data. The estimation error for 118 data is 81 m comparable with those based on both gravity and borehole data. Using digitized topographic data, we tested the kriging results and found that the model validation process (Thomas option) on data gave a fair representation of the overall uncertainty of the kriged values. 5 refs., 6 figs., 2 tabs.

47453 (USGS-OFR—83-846, pp 19-22) **Historical overview, current status of knowledge and seismological research in the New Madrid seismic zone.** Nuttli, O.W. (Saint Louis Univ., MO). 1983. Geological Survey, Box 25425, Denver Federal Center, Denver CO 80225. File Number TI85900612. (CONF-8309330—).

From Workshop on continuing actions to reduce potential losses from future earthquakes in Arkansas and nearby states; North Little Rock, AR, USA (20 Sep 1983).

The New Madrid seismic zone is a classic example of a low-probability, high-risk phenomenon. Moderately large earthquakes will affect an area the size of one or several States, and great earthquakes, such as those of the winter of 1811-1812, will disrupt to various degrees, the lives of approximately half the population of the United States. Because these earthquakes occur infrequently, they pose some unique problems to those responsible for hazard mitigation and disaster response, as well be discussed throughout this workshop. The purpose of this paper is to present a non-technical summary of the historical and present-day earthquake activity, and to describe briefly some of the seismological research that relates to the objectives of the workshop.

47454 **P-wave fault-plane solutions and the generation of surface waves by earthquakes in the western United States.** Patton, H.J. (Earth Sciences Department, Lawrence Livermore National Laboratory, University of California). *Geophysical Research Letters;* **12**: No. 8, 518-521(Aug 1985).

Surface waves recorded at regional distances are used to study the source mechanisms of seven earthquakes in the western United States with magnitudes between 4.3 and 5.5. The source mechanisms of events in or on the margins of the Basin and Range show T-axis which an azimuth of N85°W+/-16° and a plunge of 12°+/-16°. Of the seven events, four have P-wave solutions that are inconsistent with surface-wave observations. Azimuths of the T-axis obtained from the surface-wave mechanisms and from the P-wave solutions differ by up to 45°. These events have dipslip or oblique-slip mechanisms, and the source depths for three of the events are 5 km or less. Their source mechanisms and small magnitudes make identification of the P-wave first motion difficult due to poor signal-to-noise ratio of the initial P-wave and close arrivals of pP or sP with significant amplitude. We suggest that mis-identification of the P-wave first motion and distortion of the body-wave ray paths due to non-planar structure were sources of error in determining the nodal planes for these events.

47455 **Three-dimensional treatment of convective flow in the earth's mantle.** Baumgardner, J.R. (Theoretical Division, Group T-3, University of California, Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Journal of Statistical Physics;* **39**: No. 3, 501-512(Jun 1985).

A three-dimensional finite-element method is used to investigate thermal convection in the earth's mantle. The equations of motion are solved implicitly by means of a fast multigrid technique. The computational mesh for the spherical problem is derived from the regular icosahedron. The calculations described use a mesh with 43,554 nodes and 81,920 elements and were run on a Cray X. The earth's mantly is modeled as a thick spherical shell with isothermal, free-slip boundaries. The infinite Prandtl number problem is formulated in terms of pressure, density, absolute temperature, and velocity and assumes an isotropic Newtonian rheology. Solu-

tions are obtained for Rayleigh numbers up to approximately $10^6$ for a variety of modes of heating. Cases initialized with a temperature distribution with warmer temperatures beneath spreading ridges and cooler temperatures beneath present subduction zones yield whole-mantle convection solutions with surface velocities that correlate well with currently observed plate velocities.

47456 **Imnaha Basalt, Columbia River basalt group.** Hooper, P.R.; Kleck, W.D.; Knowles, C.R.; Reidel, S.P.; Thiessen, R.L. (Washington State Univ., Pullman). *Journal of Petrology;* **25**: No. 2, 473-500(May 1984). Contract AI06-78DP01078.

The Columbia River volcanic episode began with the eruption of the coarsely porphyritic Imnaha Basalt between 17.0 and 16.5 my BP. Lava poured from NNW trending vertical fissures and local vents north and south of the Seven Devils-Wallowa Mountains divide, covering a deeply dissected topographic surface of more than 30,000 $km^2$, with an estimated volume of 6000 $km^3$. A minimum of 26 flows or flow units are represented in 14 or 15 members. These include 11 chemical types and are exposed in sections ranging to 577 m in thickness. All flows have normal polarity with the exception of the youngest and oldest whose polarity is either reversed or transitional. Using major and trace elements, the flows of Imnaha Basalt are clearly distinguished from those of all other formations of the Columbia River Basalt Group. 52 references, 14 figures, 9 tables.

## 5803 Mineralogy, Petrology, And Rock Mechanics

*REFER ALSO TO CITATION(S) 46190, 46579, 46590, 47186, 47456*

47457 **(EUR—9205) Thermo-mechanical behaviour of a salt dome with a heat-generating waste repository.** Janssen, L.G.J.; Prij, J.; Kevenaar, J.W.A.M.; Jong, C.J.T.; Klok, J.; Beemsterboer, C. (Commission of the European Communities, Luxembourg). 1984. 158p. NTIS (US Sales Only), PC A08/MF A01. File Number DE85702223.

This report reviews the analytical work on the disposal of radioactive waste in salt domes performed at ECN in the period 1 January 1980 to 31 December 1982. Chapter 4 in the main report covers the global temperature and deformation analyses of the salt dome and the surrounding rocks. The attached three topical reports cover self-contained parts of the study. The computer program TASTE developed to analyse, at acceptable cost and with, for engineering purposes, sufficient accuracies, the temperature rises in the salt dome due to the stored heat-generating waste is described in Annex 1. Annex 2 gives a description of the extended finite element program GOLIA. The program has been extended to make it suitable for the creep analysis of salt domes with repositories of heat-generating waste. The study on the closing and sealing of boreholes wit heat-generating waste is reported in Annex 3.

47458 **(INFO—0092) Case history of the Marysville geothermal anomaly from a nuclear waste disposal perspective.** Tammemagi, H.Y.; Grisak, G.E.; Parrish, D.K. (RE/SPEC Ltd., Calgary, Alberta (Canada); Atomic Energy Control Board, Ottawa, Ontario (Canada)). Mar 1983. 65p. NTIS (US Sales Only), PC A04/MF A01. File Number DE85702224.

A case history of a mild geothermal area near Marysville, Montana has been compiled in order to learn about the effects that long-term heat generated by an irradiated fuel repository might have on the surrounding rock mass. The results of geological and geophysical surveys are summarized and the hydrogeological conditions in the granite mass, as measured in a 2 km deep borehole, are described. A model is proposed which accounts for the hydrothermal circulation and explains some of the geophysical observations. The implications to deep burial of nuclear wastes are discussed.

47459 **(SAND—84-2244C) Time-dependent damage and creep of brittle rock.** Costin, L.S. (Sandia National Labs., Albuquerque, NM (USA)). 1985. Contract AC04-76DP00789. 21p. (CONF-851039—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85008410.

From American Society of Civil Engineers fall meeting; Detroit, MI, USA (1 Oct 1985).

Results of a combined analytical-experimental study of the relationship between subcritical microcrack growth due to stress corrosion and the time-dependent deformation and failure of brittle rock are reported. An analysis of creep and failure under uniaxial stress was performed using a continuum damage model. The model includes evolutionary equations which describe the growth of microcracks due to stress corrosion as well as incremental increases in applied stress. Also, the effect of interaction between neighboring cracks on the rate of crack growth is included. The model was used to predict the relationship between strain rate and failure stress for uniaxial compression at constant strain rate. These results are compared to the results of uniaxial compression experiments on Tennessee marble. A further implication of the analytical results is that if the material is stressed below a threshold stress level and allowed to creep, the creep rate should decay to zero over time and no failure will occur. However, if the threshold stress level is exceeded, the damage level will continue to evolve, resulting in an eventual acceleration of the creep rate (tertiary creep) and failure. To test this result, creep experiments at stress levels above and below the threshold stress level determined from the constant strain rate tests were performed. The results tend to confirm the model prediction; however, because only relatively short term tests could be performed (10 to 15 days maximum), we were not able to observe a complete decay of the creep rate at stresses below the threshold.

47460 **(UCRL—90774-Rev.2) Rheological properties of molten Kilauea Iki basalt containing suspended crystals. Revision 2.** Weed, H.C.; Ryerson, F.J.; Piwinskii, A.J. (Lawrence Livermore National Lab., CA (USA)). 1984. Contract W-7405-ENG-48. 15p. (CONF-840805—31-Rev.2). NTIS, PC A02/MF A01; GPO Dep. File Number DE85014180.

From 188. meeting of the American Chemical Society; Philadelphia, PA, USA (26 Aug 1984).

In order to model the flow behavior of molten silicate suspensions, such as magmas and slags, the rheological behavior must be known as a function of the concentration of suspended crystals, melt composition, and external conditions. We have determined the viscosity and crystallization sequence for a Kilauea Iki basalt between 1250°C and 1149°C at 100 kPa total pressure and $fO_2$ corresponding to the quartz-fayalite-magnetite buffer in an iron-saturated Pt30Rh rotating cup viscometer of the Couette type. The apparent viscosity varies from 9 to 879 Pa.s. The concentration of suspended cyrstals varies from 18 volume percent at 1250°C to 59 volume percent at 1149°C. The molten silicate suspension shows power-law behavior: log tau yx = $A_0$ + $A_1$ log du/dx, where tau/sub yx/ is the shear stress and (du/dx) the shear rate. Since $A_1 \leq 1$, the apparent viscosity decreases with increasing shear rate and the system is pseudoplastic. 15 refs., 4 figs., 5 tabs.

47461 **(UCRL—92358) Effective medium theory for partially saturated porous solids.** Berryman, J.G.; Thigpen, L. (Lawrence Livermore National Lab., CA (USA)). Jul 1985. Contract W-7405-ENG-48. 16p. (CONF-850787—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85016608.

From Multiple scattering of waves in random media and random rough surfaces; University Park, PA, USA (29 Jul 1985).

In the theory of elastic composites, one may construct an effective medium theory by choosing the effective moduli so the forward scattering from isolated elastic inclusions vanishes on average. In the theory of partially saturated porous media, the analogous problem requires knowledge of the multipole scattering coefficients for elastic scattering from isolated inhomogeneities in a fluid-saturated porous medium. Using Biot's equations of poroelasticity, these coefficients for single-scattering from spherical inhomogeneities have been calculated. When these coefficients are used to construct an effective medium theory, the resulting formulas for the effective density and bulk modulus of the composite (liquid/gas) fluid recover Wood's well-known results. Equations for wave propagation through partially saturated porous media with the coefficients determined by the effective medium results predict wave speeds agreeing with experiment in the seismological frequency range. 24 refs., 2 figs.

47462 **Dehydroxylation of kaolinite.** Yeskis, D.; van Groos, A.F.K.; Guggenheim, S. (Univ. of Illinois, Chicago). *American Mineralogist;* 70: No. 1-2, 159-164(Jan-Feb 1985).

High pressure DTA experiments show that the dehydroxylation of kaolinite in dry runs with P(Total) = P(argon) proceeds at 525°C and 1 bar to 627°C at 30.5 bars. Further increase in pressure slowly increases the dehydroxylation temperature, at 5270 bars it occurs at 670°C. Under conditions of P(total) = P($H_2O$), dehydroxylation occurs at 650°C at 46.5 bars and 520°C at 1088 bars after which it increases to 571°C at 5716 bars. The results are explained by postulating the presence of a liquid-like, meta-liquid phase, having a pressure-dependent $H_2O$ solubility. P-T relations of the kaolinite dehydroxylation reactions are best explained by assuming that they are metastable equilibrium reactions around a metastable invariant point at 625°C and 25 bars and a singular point at 640°C and 40 bars.

47463 **Coupled thermal-hydraulic-mechanical phenomena in saturated fractured porous rocks: numerical approach.** Noorishad, J.; Tsang, C.F.; Witherspoon, P.A. (Lawrence Berkeley Lab., CA). *Journal of Geophysical Research;* 89: No. B12, 10,365-10,373(10 Nov 1984). Contract AC03-76SF00098.

The fundamentals of the theory of consolidation and thermoelasticity are recast into the formulation of a phenomenon called thermohydroelasticity. Subsequently, a variational principle and Galerkin formulation are combined with the finite element method to develop a new technique to investigate coupled thermal-hydraulic-mechanical behavior of liquid-saturated, fractured porous rocks. A code-to-code verification of the method is performed. Finally, the environment of a heater emplaced in hard rock is simulated. The effects of the coupled thermal stresses in the fractured rock are evident from the dramatic reduction of permeability due to the deformation of the fractures. These results can improve the understanding of observations and displacement measurements made in the in situ experiments at the Stripa mine in Sweden. 46 references.

## 5804 Geochemistry

*REFER ALSO TO CITATION(S) 46145, 46146, 46147, 46150, 46181*

47464 **(NP—5770366) Studies on the organic geochemistry and coal-petrographic aspects of offshore sediments.** Dick, H. von der. (Technische Hochschule Aachen (Germany, F.R.). Fakultaet fuer Bergbau und Huettenwesen). 29 Apr 1983. 318p. (In German). NTIS (US Sales Only), PC A14/MF A01. File Number DE85770366.

Drill cores of the 'Deep Sea Drilling Project' (DSDP) were studied by organic geochemical analysis and coal petrography in order to define the organic matter contained in offshore marin sediments. In these studies on soluble, extractable organic matter, interest focussed on the so-called 'geochemical fossils' whose characteristic structure and distribution yields information on the type and composition of the lipid matter as well as on the possible precursor organisms. Further, oceanographic data and sedimentation theories are discussed in order to find the reasons for the great differences between the (organic) marine facies areas.

47465 **Geochemistry of iodine in near-shore carbonate sediments.** Ullman, W.J.; Aller, R.C. (Univ. of Chicago, IL). *Geochimica et Cosmochimica Acta;* 49: No. 4, 967-978(Apr 1985).

The total concentration of I is commonly higher in surface terrigenous sediments relative to more deeply buried material. Diagenetic release, loss of dissolved I during burial, and back-retention of I with the solid phase under oxidizing conditions contribute to I enrichment near the sediment/water interface. In order to differentiate between scavenging of dissolved I by organic matter or metal oxides, the diagenetic behavior of I was examined in the Fe-poor carbonate sediments of Florida Bay, Florida. In this environment I is released by organic decomposition of I/C ratios similar to terrigenous environments (~ 0.5 mmole/mole), transported to the oxygenated sediment/water interface, and lost to the overlying water. The dissolved I flux from these deposits is roughly equivalent to the production rate within the deposit (~ 10 μmole/$m^2$/day at 28°C). No significant enrichment is observed in the solid phase. Dissolved iodine transport within the sediment column may also be controlled by non-steady-state lateral diffusion into burrows. These observations, together with laboratory experiments which demonstrate $IO_3^-$ scavenging by Fe-oxyhydroxides at pH ≦ 8, imply that enrichment of I in terrigenous surface sediments results predominantly from the initial oxidation of $I^-$ to $IO_3^-$ by microorganisms, followed by sorption on Fe oxides. Upon burial and reduction during anaerobic decomposition, this metal-associated I is released to solution, in a manner similar to phosphate. 79 references, 12 figures, 3 tables.

47466 **Estimation of the dielectric constant of $H_2O$ from experimental solubilities of quartz, and calculation of the thermodynamic properties of aqueous species to 900°C at 2 kb.** McKenzie, W.F.; Helgeson, H.C. (Univ. of California, Berkeley). *Geochimica et Cosmochimica Acta;* 48: No. 11, 2167-2177(Nov 1984). Contract W-7405-ENG-48.

Experimental quartz solubilities in $H_2O$ were used together with equations of state for quartz and aqueous species to calculate the dielectric constant of $H_2O$ (epsilon/sub $H_2O$/) at pressures and temperatures greater than those for which experimental measurements are available (0.001 ≦ P ≦ 5 kb and 0 ≦ T ≦ 600°C). Estimates of epsilon/sub $H_2O$/ computed in this way for 2 kb (which are the most reliable) range from 9.6 at 600°C to 5.6 at 800°C. The estimates of epsilon/sub $H_2O$/ generated from quartz solubilities at 2 kb were fit with a power function of temperature, which was then used together with equations and data to calculate Born functions, Debye Hueckel parameters, and the thermodynamic properties of $Na^+$, $K^+$, $Mg^{++}$, $Ca^{++}$, and other aqueous species of geologic interest at temperatures to 900°C.

47467 **Genetic implications of halide enrichment near a Mississippi Valley-type ore deposit.** Panno, S.V.; Harbottle, G.; Sayre, E.V.; Hood, W.C. (Brookhaven National Lab., Upton, NY). *Economic Geology and the Bulletin of the Society of Economic Geologists;* 78: 150-156(1983).

Analysis of host dolomite adjacent to the Buick lead-zinc-copper deposit, Viburnum Trend, southeast Missouri, by instrumental neutron activation (INAA) and X-ray fluorescence (XRF) has revealed large and distinct primary wall-rock enrichments of bromine and chlorine, respectively. The halide enrichment extends up to 250 ft from the deposit and is found in close association with trace element enrichments. The presence of the Br and Cl enrichment zone is strong additional evidence that the ore-forming solutions of the Viburnum Trend were metal-rich Na-Cl brines. The Br/Cl ratios of the dolomite samples also display an asymptotic decrease with distance from the deposit. The elevated Br/Cl ratios of the rock samples and their soluble fractions indicate that the ore-forming solutions were initially formed from the evaporation of seawater past the point of halite precipitation. This implies that the ore-forming solutions of the Buick mine and Viburnum Trend deposits evolved from bitterns which formed contemporaneously with an evaporite sequence. These bitterns subsequently underwent mixing with less saline waters prior to or during ore mineralization. 18 references, 3 figures, 2 tables.

## 5805 Oceanography

47468 **Properties of flow within the coastal boundary layer off Long Island, New York.** Churchill, J.H. (Woods Hole Oceanographic Institution, Woods Hole, MA 02543). *Journal of Physical Oceanography;* 15: No. 7, 898-916(Jul 1985).

Properties of flow within the nearshore waters off the southern coast of Long Island are established by statistical analysis of data from a moored current meter array and by concurrent hydrographic information. Upwelling—downwelling episodes dominate subdiurnal frequency fluctuations of the flow within a coastal boundary layer of about 10 km width. The structure of the boundary layer appears to be baroclinic during the presence of a pycnocline, and is also influenced by frictional effects because of the increase of bottom depth with distance from shore. Significant mean offshore flow is evidenced by measurements taken in autumn and later summer, despite negligible mean wind stress during the same

periods. This flow is most likely related to the large longshore density gradients which are consistently inferred from hydrographic data taken in the vicinity. During events of roughly constant wind heading, the cross-shore flow of a particular direction is often confined within a distinct density band. This has made it possible to infer cross-shore flow which was otherwise unresolved by the current meter array.

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47469 **(INIS-mf—9351, pp 553-563) 1983 adjustment of the fundamental physical constants.** Cohen, E.R. (Rockwell International Corp., Thousand Oaks, CA). 1984. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781594. (CONF-8409143—).

From 7. international conference on atomic masses and fundamental constants (AMCO-7); Darmstadt-Seeheim, F.R. Germany (3 Sep 1984).

The author describes the new fixation of the value of the light velocity by the hitherto most accurate measured value and new determinations of the Rydberg constant, the magnetic moment of the proton, the g factor of the electron and the muon, the hyperfine splitting frequency of the ground state in hydrogen, the magnetic moment of the muon, the quantized Hall constant, the gyromagnetic ratio of the proton, and the Avogadro constant. (HSI).

## 6401 Astrophysics And Cosmology

*REFER ALSO TO CITATION(S) 47079, 47896*

47470 **(AD-A—154354/5/XAB) Magnetospheres of the outer planets. Progress report.** Van Allen, J.A. (Iowa Univ., Iowa City (USA). Dept. of Physics and Astronomy). Apr 1985. 29p. (U-OF-IOWA—85-10). NTIS, PC A03/MF A01.

The physical conditions that are necessary for the existence of a planetary magnetosphere are reviewed. These general considerations and some specific evidence are then combined to make forecasts of the probable existence and nature of magnetospheres of Uranus and Neptune.

47471 **(CONF-850605—4) Feasibility of $^{81}Br(nu,e^-)^{81}Kr$ solar neutrino experiment.** Hurst, G.S.; Allman, S.L.; Chen, C.H.; Kramer, S.D.; Thomson, J.O.; Cleveland, B. (Oak Ridge National Lab., TN (USA); Tennessee Univ., Knoxville (USA). Dept. of Physics; Brookhaven National Lab., Upton, NY (USA)). May 1985. Contract AC05-84OR21400. 8p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016380.

From 7. international conference on laser spectroscopy; Maui, HI, USA (24 Jun 1985).

Several ingenious solutions have been offered for the solar neutrino problem - a defect in the solar model, the appearance of a new type of neutrino physics, the sun is no longer burning, etc. The range of these proffered solutions stresses the need for a new experiment to study the sun. The modern pulsed laser now makes possible a new solar neutrino test which examines an independent neutrino source in the sun. A recently proposed experiment would use the reaction $^{81}Br(nu,e^-)^{81}Kr$ to measure the flux of $^7Be$ neutrinos from the sun. When $^7Be$ decays by electron capture to make $^7Li$, a neutrino is emitted at 0.862 MeV and the flux of these on the earth is about $4 \times 10^9$ cm$^{-2}$ s$^{-1}$, according to the standard model. Therefore, an experiment based on $^{81}Br(nu,e^-)^{81}Kr$ which is sensitive to these lower energy neutrinos would be of fundamental importance. To first order, the chlorine experiment detects the $^8B$ neutrinos while bromine detects the much more abundant $^7Be$ neutrino source. In practice, the proposed bromine experiment would be very similar to the chlorine radiochemical experiment, except that $^{81}Kr$ with a half-life of $2 \times 10^5$ years cannot be counted by decay methods. With an experiment of about the same volume as the chlorine experiment (380 m$^3$) filled with $CH_2Br_2$, the model predicts about 2 atoms of $^{81}Kr$ per day. The bromine experiment depends entirely on the RIS method, implemented with pulsed lasers, for its success. 10 refs., 3 figs.

47472 **(FNAL/C—85-100-A) New and old accelerators: what can they do for astrophysics.** Bjorken, J.D. (Fermi National Accelerator Lab., Batavia, IL (USA)). Jul 1985. Contract AC02-76CH03000. 10p. (CONF-8405155—8). NTIS, PC A02/MF A01; GPO Dep. File Number DE85013220.

From Inner space/outer space conference; Batavia, IL, USA (2 May 1984).

The quantum numbers and energy spectrum of high energy accelerators and storage rings are described, along with some ways they may contribute to astrophysical issues. Some emphasis is given to the role of relativistic heavy-ion colliders in possibly providing laboratory samples of quark-gluon plasma. 6 refs., 3 figs.

47473 **(FRNC-TH—1636) Properties of hot gas in halos of active galaxies and clusters of galaxies.** Durret-Isnard, F. (Paris-7 Univ., 75 (France)). May 1982. 110p. (In French). NTIS (US Sales Only), PC A06/MF A01. File Number DE85752176.

The importance of the inverse Compton effect in the X-ray emission of cluster galaxies is discussed; the X-ray origin problem from galaxy clusters (spectra and emission mechanisms) is studied. The insufficiency of the X-ray bremsstrahlung emission model in an isothermal gas is proved. The ionized halos in narrow-line galaxies (NLG) are studied; after some general points on NLG, one NLG is described and a brief view an emission mechanism models is given; a detailed study of the galaxy IC 5063 and its nebulosity is given: the ionized gas density is calculated together with the evaporation rate for such clouds.

47474 **(JINR—R-2-84-540) Antiproton annihilation in helium as a test of models, based on N = 1 supergravity.** Linde, A.D.; Falomkin, I.V.; Khlopov, M.Yu. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1984. 5p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE85702081.

The possibility is examined of solving the problem of relict gravitinos within the framework of the model of an inflationary Universe. Recently it was shown that strong restrictions on the concentration of gravitinos are related to the effective output fsub(D)($^3$He) of deuterium or helium 3 in anti p $^4$He-annihilation. The influence of a low concentration of gravitinos in the early Universe on the parameters of the theory of its evolution is studied. The methods used are those adopted in the model of an inflating Universe based on N=1 supergravity. For a gravitino concentration Ysub(3/2) <= $10^{-12}$ the temperature of the Universe is obtained to equal to Tsub(R) <= $10^8$ GeV, after its having been heated. It is noted that generation of baryon asymmetry after the inflation of the Universe is possible even in theories where Tsub(R) <= $10^8$ GeV. The results obtained in this case lead to certain rather strong restrictions on a possible structure of the theory, which are necessary for providing an effective generation of the baryon asymmetry after inflation and to prevent a too abundant formation of primary black holes. Since the obtained results depend drastically on the actual value of fsub(D)(sup(3) sub(He)), the experimental investigation of anti p$^4$He-annihilation turns out to be extremely important.

47475 **(PB—85-189983/XAB) Initial conditions for inflation.** Coughlan, G.D.; Ross, G.G. (Oxford Univ. (UK). Dept. of Theoretical Physics). 1984. 16p. NTIS, PC E03/MF E03.

The concept of cosmological inflation was first proposed to explain several long-standing problems in the standard Big-Bang cosmology. Since then, the concept has evolved into what is now known as the new inflationary universe, which provides an attractive and believable extension of the standard cosmological model. However, the implementation of this inflationary picture of the universe has usually assumed a choice of initial conditions, which, although at first sight plausible, is actually too naive. The necessary conditions for inflation are discussed. In order to account for quantum and thermal fluctuations in the inflaton field, phi, one must consider a distribution of initial values for phi. Then the requirement that inflation be natural, leads to a constraint on the form of the potential V(phi). Examples of three different means of preparing acceptable initial conditions are presented.

**47476 (SAND—85-1522C) Gamma-ray imaging spectrometer (GRIS): a new balloon-borne experiment for gamma-ray line astronomy.** Teegarden, B.J.; Cline, T.L.; Gehrels, N.; Porreca, G.; Tueller, J.; Leventhal, M.; Huters, A.F.; MacCallum, C.J.; Stang, P.D. (National Aeronautics and Space Administration, Greenbelt, MD (USA). Goddard Space Flight Center; Bell Labs., Murray Hill, NJ (USA); Sandia National Labs., Albuquerque, NM (USA)). 1985. Contract AC04-76DP00789. 5p. (CONF-850883—8). NTIS, PC A02/MF A01; GPO Dep. File Number DE85015815.

From 19. international cosmic ray conference; La Jolla, CA, USA (11 Aug 1985).

High resolution gamma-ray spectroscopy is a relatively new field that holds great promise for further understanding of high energy astrophysical processes. Preliminary results such as the annihilation radiation from the galactic center, the $^{26}$Al line from the galactic plane and cyclotron lines from neutron stars may well be just the initial discoveries of a rich and as yet undeveloped field. When the high resolution gamma-ray spectrometer (GRSE) was removed from the GRO payload NASA decided to initiate a balloon program to permit continued development and improvement of instrumentation in this field, as well as continued scientific observations. The Gamma-Ray Imaging Spectrometer (GRIS) is one of the experiments selected as part of this program. The instrument contains a number of new and innovative features that are expected to produce a significant improvement in source location accuracy and sensitivity over previous balloon and satellite experiments. 6 refs., 2 figs.

**47477 (UCRL—92510) Stellar core collapse and supernova.** Wilson, J.R.; Mayle, R.; Woosley, S.E.; Weaver, T. (Lawrence Livermore National Lab., CA (USA)). Apr 1985. Contract W-7405-ENG-48. 47p. (CONF-841238—1). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85017398.

From 12. Texas symposium of relativistic astrophysics; Jerusalem, Israel (17 Dec 1984).

Massive stars that end their stable evolution as their iron cores collapse to a neutron star or black hole long been considered good candidates for producing Type II supernovae. For many years the outward propagation of the shock wave produced by the bounce of these iron cores has been studied as a possible mechanism for the explosion. For the most part, the results of these studies have not been particularly encouraging, except, perhaps, in the case of very low mass iron cores or very soft nuclear equations of state. The shock stalls, overwhelmed by photodisintegration and neutrino losses, and the star does not explode. More recently, slow late time heating of the envelope of the incipient neutron star has been found to be capable of rejuvenating the stalled shock and producing an explosion after all. The present paper discusses this late time heating and presents results from numerical calculations of the evolution, core collapse, and subsequent explosion of a number of recent stellar models. For the first time they all, except perhaps the most massive, explode with reasonable choices of input physics. 39 refs., 17 figs., 1 tab.

**47478 (UCRL—92823-Rev.1) Optical pulsations in AM Her systems. Revision 1.** Langer, S.H. (Lawrence Livermore National Lab., CA (USA)). Jun 1985. Contract W-7405-ENG-48. 11p. (CONF-8506143—4-Rev.1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85017280.

From 9. North American workshop on cataclysmic variables; Seattle, WA, USA (24 Jun 1985).

The AM Her systems are widely believed to be mass transfer binaries containing a white dwarf primary accreting from a red dwarf secondary. The magnetic field of the white dwarf is so strong that it prevents the formation of an accretion disk and funnels the accretion flow into the polar caps of the white dwarf. The accreting matter is decelerated from free fall by passage through a standoff shock located somewhat above the surface of the white dwarf. The hot postshock gas radiates hard x-rays and electron cyclotron emission and cools until it settles onto the photosphere. Middleditch (1982) reported the discovery of a broad feature between 0.4 and 0.8 Hz in the power spectrum of AN UMa and E1405-451. Observations of AM Her and of AN UMa in its faint state did not show similar features. This feature was tentatively identified with the instability discovered by LCS, but it was clear that improved observations and models were both required to confirm the identification. Recent observations by Larsson (1985) confirm the presence of the feature in the power spectrum of E1405-451 and show clearly visible pulsations in the light curves as well as demonstrating that the pulsation is predominantly in red light. As a result it seems worthwhile to present theoretical predictions for optical pulsations. The model of the system is described, emphasizing the general physics of the problem at the expense of details about the numerical aspects. Some of the expected properties of the optical emission are presented, and the observations and model improvements that are of the most immediate interest are suggested. 16 refs., 4 figs.

**47479 (UCRL—92919) Dissociative recombination of interstellar ions: electronic structure calculations for $HCO^+$.** Kraemer, W.P.; Hazi, A.U. (Max-Planck-Institut fuer Physik und Astrophysik, Garching (Germany, F.R.). Inst. fuer Astrophysik; Lawrence Livermore National Lab., CA (USA)). 2 Jul 1985. Contract W-7405-ENG-48. 16p. (CONF-8407142—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85017261.

From NATO advanced study institute on molecular astrophysics: state of the art and future directions; Garching, F.R. Germany (1 Jul 1984).

The present study of the interstellar formyl ion $HCO^+$ is the first attempt to investigate dissociative recombination for a triatomic molecular ion using an entirely theoretical approach. We describe a number of fairly extensive electronic structure calculations that were performed to determine the reaction mechanism of the e-$HCO^+$ process. Similar calculations for the isoelectronic ions $HOC^+$ and $HN_2^+$ are in progress. 60 refs.

**47480 (UCRL—93154) Harmonically excited orbital variations.** Morgan, T. (Lawrence Livermore National Lab., CA (USA)). 6 Aug 1985. Contract W-7405-ENG-48. 11p. (CONF-8510146—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85017102.

From International astronautical federation congress; Stockholm, Sweden (7 Oct 1985).

Rephrasing the equations of motion for orbital maneuvers in terms of Lagrangian generalized coordinates instead of Newtonian rectangular cartesian coordinates can make certain harmonic terms in the orbital angular momentum vector more readily apparent. In this formulation the equations of motion adopt the form of a damped harmonic oscillator when torques are applied to the orbit in a variationally prescribed manner. The frequencies of the oscillator equation are in some ways unexpected but can nonetheless be exploited through resonant forcing functions to achieve large secular variations in the orbital elements. Two cases are discussed using a circular orbit as the control case: (1) large changes in orbital inclination achieved by harmonic excitation rather than one impulsive velocity change, and (2) periodic and secular changes to the longitude of the ascending node using both stable and unstable excitation strategies. The implications of these equations are also discussed for both artificial satellites and natural satellites. For the former, two utilitarian orbits are suggested, each exploiting a form of harmonic excitation. 5 refs.

**47481 Evaporation of strange matter in the early Universe.** Alcock, C.; Farhi, E. (Center for Theoretical Physics, Center for Space Research and Department of Physics, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139). *Physical Review* [*Section*] *D: Particles and Fields;* **32**: No. 6, 1273-1279(15 Sep 1985). Contract AC02-76ER03069.

Strange matter, a stable form of quark matter containing a large fraction of strange quarks, may have been copiously produced when the Universe had a temperature of $\sim$100 MeV. We study the evaporation of lumps of strange matter as the Universe cooled to 1 MeV. Only lumps with baryon number larger than $\sim 10^{52}$ could survive. This places a severe restriction on scenarios for strange-matter production.

47482 **Revival of a stalled supernova shock by neutrino heating.** Bethe, H.A.; Wilson, J.R. (Laboratory of Nuclear Studies, Cornell University). *Astrophysical Journal;* **295**: No. 1, 14-23(1 Aug 1985). Contract W-7405-ENG-48.

We analyze the mechanism for revival of a stalled supernova shock found by one of us (J. R. W.) in a computation. Neutrinos from the hot, inner core of the supernova are absorbed in the outer layers, and although only about 0.1% of their energy is so absorbed, this is enough to eject the outer part of the star and leave only enough mass to form a neutron star. The neutrino absorption is independent of the density of material. After the shock recedes to some extent, neutrino heating establishes a sufficient pressure gradient to push the material beyond about 150 km outward, while the material further in falls rapidly toward the core. This makes the density near 150 km decrease spectacularly, creating a quasi-vacuum in which the pressure is mainly carried by radiation. This is a perfect condition to make the internal energy of the matter sufficient to escape from the gravitational attraction of the star. The net energy of the outgoing shock is about 4 x $10^{50}$ ergs.

47483 **Universal mass-luminosity relation for quasars and active galactic nuclei?.** Wandel, A.; Yahil, A. (Astronomy Program, University of Maryland). *Astrophysical Journal, Letters to the Editor;* **295**: No. 1, L1-L4(1 Aug 1985). Contract AC02-80ER10719.

The masses of the central sources in quasars and active galaxies are determined, assuming the H$\beta$ line velocity widths are gravitationally induced, and using the H$\beta$ luminosities to estimate the distances of the broad-line regions (BLR) from the central sources. It is found that the continuum luminosities are proportional to the masses thus determined. The average ratio of the optical continuum luminosity to the Eddington luminosity is 0.01, with a scatter of less than a factor of 3, over four orders of magnitude in luminosity. In addition, it is shown that the ratio of X-ray to H$\beta$ luminosity, which in this picture is proportional to the ionization parameter, is anticorrelated with the total luminosity. This supports previous findings that the ionization parameter in the BLR of Seyfert nuclei is higher than that of quasars.

47484 **Cosmological constraints on the lifetime of massive particles.** Lindley, D. (Theoretical Astrophysics Group, Fermi National Accelerator Laboratory). *Astrophysical Journal;* **294**: No. 1, 1-8(1 Jul 1985).

Particles with masses more than a few MeV, decaying into photons or electrons, can cause destruction by photofission of cosmologically produced light elements. A previous calculation of this effect is corrected and extended, and used to derive maximum lifetimes for massive neutrinos; these range from a few thousand seconds upward, depending on the particle mass. Some approximate expressions are given that enable lifetime limits to be obtained for other particles, with different masses and abundances, such as gravitinos. These limits are generally stronger than previously determined constraints, such as the distortion of the microwave background by energetic photons.

47485 **Analysis of nonradial pulsations of the central star of the planetary nebula K1-16.** Starrfield, S.; Cox, A.N.; Kidman, R.B.; Dean Pesnell, W. (Theoretical Division, los Alamos National Laboratory; and Department of Physics, Arizona State University). *Astrophysical Journal, Letters to the Editor;* **293**: No. 1, L23-L27(1 Jun 1985).

We have performed a linear, nonradial, nonadiabatic pulsation stability analysis of stellar models with effective temperatures of 1.50 x $10^5$ K, 1.55 x $10^5$ K, 1.60 x $10^5$ K, and 1.65 x $10^5$ K, and luminosities characteristic of stars evolving from the AGB to the white dwarf cooling sequence. Our purpose is to find unstable pulsation modes with periods as long as those observed in the central star of the planetary nebula, K1-16. These models have masses of 0.6 M/sub sun/ and homogeneous compositions of half-carbon and half-oxygen by mass. All these stellar models exhibit unstable nonradial modes with periods ranging from 1000 to 4000 s. The longest periods were found in the model with T/sub e/ = 1.55 x $10^5$ K, L = 2000 L/sub sun/. The pulsation driving mechanism is the cyclical ionization of carbon and oxygen at temperatures of (2—5) x $10^6$ K. This analysis demonstrates that K1-16 is probably a member of the PG 1159-035 class of sdO variable stars. This star is, therefore, an evolutionary link from the central stars of the OVI planetary nebulae to the hottest non-Da white dwarfs as proposed by Sion, Liebert, and Starrfield. It must also be evolving very rapidly.

47486 **Magnetic field propagation in a stellar dynamo.** Glatzmaier, G.A. (Theoretical Divisio, Los Alamos National Laboratory, Los Alamos, New Mexico). *Journal of Statistical Physics;* **39**: No. 3, 493-500(Jun 1985).

Numerical simulations of stellar dynamos are reviewed. Dynamic dynamo models solve the nonlinear, three-dimensional, time-dependent, magnetohydrodynamic equations for the convective velocity, the thermodynamic variables, and the generated magnetic field in a rotating, spherical shell of ionized gas. When the dynamo operates in the convection zone, the simulated magnetic fields propagate away from the equator in the opposite direction inferred from the solar butterfly diagram. When simulated at the base of the convection zone, the fields propagate in the right direction at roughly the right speed. However, owing to the numerical difficulty, a full magnetic cycle has not been simulated in this region. As a result, it is still uncertain where and how the solar dynamo operates.

47487 **Formation of galaxies.** Szalay, A.S. (California Univ., Santa Barbara (USA). Inst. for Theoretical Physics; Fermi National Accelerator Lab., Batavia, IL (USA)). *Nuclear Physics [Section] B;* **252**: No. 1/2, 113-125(25 Mar 1985). (CONF-8406234—).

From International symposium on phase transitions in the very early universe; Bielefeld, F.R. Germany (4 Jun 1984).

The present theories of galaxy formation are reviewed. The relation between peculiar velocities and the correlation function of galaxies points to the possibility that galaxies do not form uniformly everywhere. Scale invariant properties of the cluster-cluster correlations are discussed. Comparing the correlation functions in a dimensionless way, galaxies appear to be stronger clustered, in contrast with the comparison of the dimensional amplitudes of the correlation functions. Theoretical implications of several observations as Lyman-$\alpha$ clouds, correlations of faint galaxies are discussed. None of the present theories of galaxy formation can account for all facts in a natural way.

47488 **Phase transitions and dark matter problems.** Schramm, D.N. (Chicago Univ., IL (USA); Fermi National Accelerator Lab., Batavia, IL (USA)). *Nuclear Physics [Section] B;* **252**: No. 1/2, 53-72(25 Mar 1985). (CONF-8406234—).

From International symposium on phase transitions in the very early universe; Bielefeld, F.R. Germany (4 Jun 1984).

The possible relationships between phase transitions in the early universe and dark matter problems are discussed. It is shown that there are at least 3 distinct cosmological dark matter problems 1) halos; 2) galaxy formation and clustering; and 3) $\Omega = 1$, each emphasizing different attributes for the dark matter. At least some of the dark matter must by baryonic but if problems 2 and 3 are real they seem to also require non-baryonic material. However, if seeds are generated at the quark-hadron-chiral symmetry transition then alternatives to the standard scenarios may occur. At present no simple simultaneous solution (neither "hot", "warm", nor "cold") exists for all 3 problems, but non-standard solutions with strings, decaying particles or light not tracing to mass may work. An alternative interpretation of the relationship of the cluster-cluster and galaxy-galaxy correlation functions using renormalized scaling is mentioned. In this interpretation galaxies are more strongly correlated and the cluster-cluster function is not expected to go negative until > or approx. 200 Mpc. Possible phase transition origins for the cluster-cluster renormalized scale are presented as ways to obtain a dimension 1.2 fractal.

47489 **Origin of cosmological density fluctuations.** Carr, B.J. (Queen Mary Coll., London (UK); Fermi National Accelerator Lab., Batavia, IL (USA)). *Nuclear Physics [Section] B;* **252**: No. 1/2, 81-111(25 Mar 1985). (CONF-8406234—).

From International symposium on phase transitions in the very early universe; Bielefeld, F.R. Germany (4 Jun 1984).

The density fluctuations required to explain the large-scale cosmological structure may have arisen spontaneously as a result of a phase transition in the early Universe. There are several ways in

which such fluctuations may have been produced, and they could have a variety of spectra, so one should not necessarily expect all features of the large-scale structure to derive from a simple power law spectrum. Some features may even result from astrophysical amplification mechanisms rather than gravitational instability.

47490 **Dimensional reduction transition.** Kolb, E. (Fermi National Accelerator Lab., Batavia, IL (USA). Theoretical Astrophysics). *Nuclear Physics [Section] B;* **252**: No. 1/2, 321-330(25 Mar 1985). (CONF-8406234—).

From International symposium on phase transitions in the very early universe; Bielefeld, F.R. Germany (4 Jun 1984).

If there are more than four space-time dimensions, dimensions small today may have been dynamically important in the evolution of the early Universe. The transition to four space-time dimensions may have produced physically significant phenomena observable today.

## 6402 Atmospheric Physics

47491 (ESA-SP—217, pp vp) **Hot plasma and energetic particles in the Earth's outer magnetosphere: New understandings during the IMS.** Baker, D.N.; Fritz, T.A. (Los Alamos Scientific Lab., NM). Sep 1984. NTIS, PC A99/MF E03. (CONF-8406167—Pt.1).

From 25. plenary session of COSPAR; Graz, Austria (25 Jun 1984).

Accomplishments during IMS in clarifying magnetospheric particle variations in the region from geostationary orbit altitudes into the deep magnetotail are reviewed. Acceleration processes, transport processes, and loss processes are discussed. Changes in hot plasmas and energetic particle populations related to geomagnetic storm and magnetospheric substorm effects are considered. The IMS data allow a unified view as magnetospheric particles are traced from their acceleration source through the plasma sheet and outer trapping regions to their loss via ionospheric precipitation and ring current formation processes.

47492 (ESA-SP—217, pp vp) **Energetic particle sounding at the magnetopause and implications for magnetic reconnection.** Fritz, T.A.; Williams, D.J. (Los Alamos Scientific Lab., NM). Sep 1984. NTIS, PC A99/MF E03. (CONF-8406167—Pt.1).

From 25. plenary session of COSPAR; Graz, Austria (25 Jun 1984).

Measurements of energetic particle three dimensional distributions used to infer the structure of the region of the subsolar magnetopause obtained from the Medium Energy Particle Experiment onboard the ISEE-1 and 2 satellites are reviewed. Although initial interpretations of two types of energetic particle signatures argued against the topology predicted by magnetic reconnection at the magnetopause, subsequent understanding of the meaning of these observations demonstrate that the energetic particle data are uniformly consistent with the theory.

47493 (ESA-SP—217, pp vp) **Coupling of the solar wind to measures of magnetic activity.** McPherron, R.L.; Fay, R.A.; Garrity, C.R.; Bargatze, L.F.; Clauer, C.R.; Searls, C.; Baker, D.N. (California Univ., Los Angeles). Sep 1984. NTIS, PC A99/MF E03. (CONF-8406167—Pt.1).

From 25. plenary session of COSPAR; Graz, Austria (25 Jun 1984).

Linear prediction filtering was used to generate empirical response functions relating the solar wind electric field to the magnetic indices, AL, AU, Dst and ASYM. The empirical response functions were convolved with solar wind observations obtained during the International Magnetospheric Study to predict the indices. The predictions are compared with the observed indices during two, 3-day intervals. Differences between the observed and predicted indices are discussed in terms of the linear assumption and in terms of physical processes other than direct solar wind-magnetosphere interaction.

47494 **(FRNC-TH—1635) Introduction into a two-dimensional model of the photochemistry of the stratosphere of precipitations of galactic and solar protons: case of the present terrestrial magnetic field and of field reversal.** Brard, D. (Paris-6 Univ., 75 (France)). Nov 1982. 183p. (In French). NTIS (US Sales Only), PC A09/MF A01. File Number DE85752174.

In the aim of studying the climatic variations related to the reversal of the geomagnetic field, an analysis has been made of the effects of precipitations of galactic and solar protons, on oxide of nitrogen (NOsub(x) and NO) and ozone. Modifications are introduced into the one- and two-dimensional models which take into account the structure of the magnetic field. In situ measurements after the solar event of August 1972 enable changes due to the solar cycles to be introduced and the use of a 2D model to be justified.

47495 **(KGI-PREPR—065) Ion waves generated by streaming particles.** Andre, M. (Kiruna Geophysical Inst. (Sweden)). Mar 1984. 37p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85702137.

The wave modes with frequencies of the order of the ion gyrofrequency are surveyed for a broad range of electron temperatures and for all angles of propagation. The destabilization of some of these modes by ions or electrons drifting along the ambient magnetic field is studied by numerical methods. Streaming protons, oxygen ions and electrons can generate broadband ion-acoustic waves and narrowband electrostatic emissions between multiples of the ion gyrofrequency, also when some cool electrons are present. In our examples the wave spectra produced by drifting electrons are less sensitive to changes in the model parameters than spectra caused by streaming ions. The spectrum produced by an ion beam depends, for example, on the mass of the drifting ions and on the temperature of the electron distributions. These results are closely associated with observations on auroral field lines of electrostatic waves and drifting particles.

47496 **(KGI-PREPR—068) Formation of auroral arcs.** Stasiewicz, K. (Kiruna Geophysical Inst. (Sweden)). Apr 1984. 20p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85702138.

A new mechanism for auroral arc formation is presented. The characteristic linear shape of auroral arcs is determined by magnetically connected plasma clouds in the distant equatorial magnetosphere. These clouds originate as high speed plasma beams in the magnetotail and in the solar wind. It is found that the free energy for driving an auroral arc is provided by the difference of pressure between the cloud and the ambient plasma.

47497 **(SRD-R—221) Survey of turbulence models with particular reference to dense gas dispersion.** Farmer, C.L. (UKAEA Safety and Reliability Directorate, Culcheth). Dec 1982. 74p. United Kingdom Atomic Energy Authority, Wigshaw Lane, Culcheth Warrington, England. File Number TI85901934.

The equations of motion of dense gases in the atmosphere are derived. Methods of modelling these equations when the atmosphere is turbulent are reviewed. Both empirical and mathematical approaches are discussed within a common framework.

47498 **Analysis of 16 plasma vortex events in the geomagnetic tail.** Birn, J.; Hones E.W. Jr.; Bame, S.J.; Russel, C.T. (Los Alamos National Laboratory, University of California, Los Alamos, New Mexico). *Journal of Geophysical Research;* **90**: No. A8, 7449-7456(1 Aug 1985).

The analysis of 16 plasma vortex occurrences in the magnetotail plasma sheet of Hones et al. (1983) is extended. We used two- and three-dimensional plasma measurements and three-dimensional magnetic field measurements to study phase relations, energy propagation, and polarization properties. The results point toward an interpretation as a slow strongly damped MHD eigenmode which is generated by tailward traveling perturbations at the low-latitude interface between plasma sheet and magnetosheath.

47499 **Electromagnetic electron temperature anisotropy instabilities.** Gary, S.P.; Madland, C.D. (Earth and Space Science Division, Los Alamos National Laboratory, New Mexico). *Journal of Geophysical Research;* **90**: No. A8, 7607-7610(1 Aug 1985).

This paper considers electromagnetic Vlasov instabilities driven by electron temperature anisotropies in a homogeneous, nonrelativistic magnetized plasma. Numerical solutions of the full linear dispersion equation for bi-Maxwellian distribution functions and instabilities propagating parallel to the magnetic field are presented. Parametric dependences of the maximum growth rates of the electron fire hose and whistler anisotropy instabilities are given.

## 6403 Atomic, Molecular, And Chemical Physics

*REFER ALSO TO CITATION(S) 46976, 47172, 47651, 47889, 47901*

47500 (CONF-811229—, pp vp) **Secondary ion emission from adsorbate layers on polycrystalline Ni.** Schemmer, M.; Beckmann, P.; Greifendorf, D.; Benninghoven, A. (Muenster Univ., Germany, F.R.). 1981. National Physical Research Laboratory, CSIR, P.O. Box 395, Pretoria, 0001, South Africa.

From International conference on lasers (Society for Optical and Quantum Electronics); New Orleans, LA, USA (14 Dec 1981).

This work is concerned with the investigation of complex surface reactions by static secondary ion mass spectrometry (SIMS). It is demonstrated by the nickel-ethylene interaction, that for many types of surface compounds, coverage proportional values can be derived from SIMS intensity ratios of the type Ni(sub m)A(sup +)/Ni(sub m) (sup +), where A stands for the adsorbed species. By this consideration of intensity ratios, existing models of the Ni-$C_2H_4$ interaction could not only be confirmed, but even extended.

47501 (CONF-850701—2) **Mechanisms of atomic and molecular autoionization.** Berkowitz, J. (Argonne National Lab., IL (USA)). 1985. Contract W-31-109-ENG-38. 12p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85017412.

From 14. international conference on the physics of electronic and atomic collisions; Palo Alto, CA, USA (24 Jul 1985).

Progress in the understanding of autoionization is reviewed. 21 refs., 8 figs. (GHT)

47502 (CONF-850776—1) **Effects of temperature on dissociative and nondissociative electron attachment.** Christophorou, L.G.; Hunter, S.R.; Carter, J.G.; Spyrou, S.M. (Oak Ridge National Lab., TN (USA)). 1985. Contract AC05-84OR21400. 26p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85016473.

From Joint symposium on swarm studies and inelastic electron-molecule collisions; Tahoe, CA, USA (19 Jul 1985).

Results of recent studies on the effects of temperature, T, on the dissociative and nondissociative electron attachment to molecules are presented and discussed. 34 refs., 15 figs.

47503 (CONF-8111229—, pp vp) **Experience in surface analysis applied to technical material problems.** Goretzki, H. (Perkin-Elmer, Munich, Germany). 1981. National Physical Research Laboratory, CSIR, P.O. Box 395, Pretoria, 0001, South Africa.

From Symposium on surface science and its industrial implications; Pretoria, South Africa (1 Nov 1981).

Auger Electron Spectroscopy (AES) is an analytical method used to determine the chemical composition of surfaces and thin films with a depth resolution of 5 to 20 A. Surface related material problems such as corrosion, oxidation, wear, adhesion and catalysis can be solved by AES. High resolution scanning AES provides analytical capabilities for the sub-micron range which is particularly important for microelectronics and metallurgical applications. In industry AES is used for quality control, failure analysis and materials development.

47504 (CONF-8111229—, pp vp) **Surface and near-surface analysis of diamond by RBS.** Derry, T.E.; Sellschop, J.P.F. (Univ. of the Witwatersrand, Johannesburg, South Africa). 1981. National Physical Research Laboratory, CSIR, P.O. Box 395, Pretoria, 0001, South Africa.

From Symposium on surface science and its industrial implications; Pretoria, South Africa (1 Nov 1981).

Rutherford backscattering of MeV energetic ions has become a popular method for obtaining information about the near-surface region of solids. Although not a true surface technique, it is capable of yielding surface-specific information in certain cases. Examples drawn from work on diamond in our laboratory are described; they enable some interesting conclusions to be reached on the nature of the diamond surface.

47505 **(FRNC-TH—2005) Collisional ionizing process of highly excited rubidium atoms at thermal energy.** Barbier, L. (Paris-11 Univ., 91 - Orsay (France)). Dec 1984. 255p. (In French). NTIS (US Sales Only), PC A12/MF A01. File Number DE85752142.

This thesis reports a study of collisional ionising processes involving highly excited rubidium atoms at thermal energy (450 K). In a cell alkali atoms are excited by lasers. Ionisation occurs by collision with excited or ground state atoms. Ion analysis gives evidence that the main processes are Penning atomic ionisation and Hornbeck Molnar associative ionisation according to: $Rb(nl) + Rb(5p) \rightarrow Rb^+ + Rb + e^-$; $Rb(nl) + Rb(5s) \rightarrow Rb_2^+ + e^-$. Experimental results agree with theoretical study of the mechanisms. Negative ions are also observed for various levels. They are produced by the reaction: $Rb(nl) + Rb(5s) \rightarrow Rb^+ + Rb^-$. The production mechanisms are correlated to the energy of the initial excited level. The cross section for the energy pooling process is measured and interpreted. $Rb(5p) + Rb(5p) \rightarrow Rb(5d) + Rb(5s)$.

47506 (INIS-mf—9351, pp 322-326) **Optical isotope shifts for unstable samarium isotopes.** Eastham, D.A.; Walker, P.M.; Griffith, J.A.R.; Evans, D.E.; Grant, I.S.; England, J.G.; Fawcett, M.J. (Science and Engineering Research Council, Daresbury, England). 1984. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781594. (CONF-8409143—).

From 7. international conference on atomic masses and fundamental constants (AMCO-7); Darmstadt-Seeheim, F.R. Germany (3 Sep 1984).

Using a tunable dye laser beam intersecting a thermal atomic beam, optical isotope shifts and hyperfine splittings have been measured for the four unstable samarium isotopes between $^{144}$Sm and $^{154}$Sm, covering the well known transition region from spherical to deformed shapes. (orig.).

47507 (INIS-mf—9351, pp 327-333) **Nuclear moments and charge radii of europium and samarium isotopes, studied by collinear laser-ion beam spectroscopy.** Alkhazov, G.D.; Berlovich, E.Y.; Denisov, V.P.; Panteleev, V.N.; Tikhonov, V.I.; Doerschel, K.; Heddrich, W.; Huehnermann, H.; Peau, E.W.; Wagner, H. (Leningrad Inst. of Nuclear Physics, Gatchina, USSR). 1984. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781594. (CONF-8409143—).

From 7. international conference on atomic masses and fundamental constants (AMCO-7); Darmstadt-Seeheim, F.R. Germany (3 Sep 1984).

Hyperfine structures and isotope shifts in ion lines of Sm (lambda = 656.9 nm) and Eu (lambda = 604.9 nm) were investigated by means of collinear laser-ion beam spectroscopy. In a first experiment 18 stable and radioactive isotopes were studied by means of the IRIS mass separator of the LNPI and a temporarily installed laser apparatus. The performance of the apparatus is shown for the case of stable Sm isotope shifts. The radioactive $^{140}$Sm and $^{151}$Sm as well as the isotopes and isomeres of Eu were produced at the reactor and the synchrocyclotron of the LNPI. From the isotope shifts effective nuclear deformation values $\beta$sub(Is) can be deduced. $\beta$sub(Is) is very similar for isotonic Sm and Eu nuclei with one striking exception for N = 89. $^{152}$Eu is permanently and strongly deformed in contrast to sup(152m)Eu and $^{151}$Sm. In $^{151}$Sm two different nuclear shapes - belonging to the same Nilsson states - may give contributions to the nuclear mo-

ments. Isotope shifts and m.s. nuclear charge radii for Sm are given. (orig.).

47508 (INIS-mf—9351, pp 353-360) **Laser spectroscopy of francium atoms.** Touchard, F.; Thibault, C.; Bendali, N.; Duong, H.T.; Juncar, P.; Liberman, S.; Pinard, J.; Saint-Jalm, J.M.; Buettgenbach, S.; Mueller, A.C. (Centre National de la Recherche Scientifique, Orsay, France). 1984. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781594. (CONF-8409143—).

From 7. international conference on atomic masses and fundamental constants (AMCO-7); Darmstadt-Seeheim, F.R. Germany (3 Sep 1984).

New results of the atomic spectroscopy of francium are presented, concerning wavelengths, isotope shifts and hyperfine structures. Atomic and nuclear information are deduced. (orig.).

47509 (INIS-mf—9351, pp 372-378) **Probing nuclear structure with muons.** Shera, E.B. (Los Alamos National Lab., NM). 1984. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781594. (CONF-8409143—).

From 7. international conference on atomic masses and fundamental constants (AMCO-7); Darmstadt-Seeheim, F.R. Germany (3 Sep 1984).

Three recent muonic-atom experiments will be discussed that (a) involve connections with, or are relevant to, other types of experiments and (b) have provided interesting new nuclear physics results. (orig.).

47510 (INIS-mf—9652, pp 61) **Multiple scattering in the backscattering of energetic ions from thin foils.** Janeschitz-Kriegl, J. (Johannes Kepler Univ., Linz (Austria). Inst. fuer Experimentalphysik). 1984. (In German). NTIS (US Sales Only), PC A07/MF A01. File Number DE85781476. (CONF-8409235—Summ.).

From Annual meeting of the Austrian Physical Society; Leoben, Austria (24 Sep 1984).

Published in summary form only.

47511 (INIS-mf—9652, pp 62) **Calculation of the shielded Rutherford cross sections and check by a precise dose determination by current integration.** Golser, R.; Bauer, P.; Semrad, D. (Johannes Kepler Univ., Linz (Austria). Inst. fuer Experimentalphysik). 1984. (In German). NTIS (US Sales Only), PC A07/MF A01. File Number DE85781476. (CONF-8409235—Summ.).

From Annual meeting of the Austrian Physical Society; Leoben, Austria (24 Sep 1984).

Published in summary form only.

47512 (IS-M—549) **Electronic structure of rare earth metals and intermetallics.** Harmon, B.N. (Ames Lab., IA (USA)). 1985. Contract W-7405-ENG-82. 8p. (CONF-8509133—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85015523.

From International conference on rare earth-development and applications; Beijing, China (10 Sep 1985).

A review is given of recent progress in electronic structure determinations and in the development of new techniques for studies of electron-lattice coupling and magnetism. 24 refs., 6 figs.

47513 (JINR—E-1-84-560) **Application of cycle-by-cycle kinetic formulae to the description of muon-catalyzed fusion in deuterium.** Gula, A.; Budak, M.; Niwicki, J. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1984. 8p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85702053.

The kinetic formulae developed recently for the cycle-by-cycle description of muon catalyzed fusion are confronted with the first data on the time distributions of fusion events ending the consecutive cycles which have become available for deuterium at room temperature and 91.6 atm pressure. It is shown that the formulae provide an adequate description of the data. The data reveal interesting features which indicate that a cycle-by-cycle analysis of the muon-catalysis fusion chain can be a rich source of information about the parameters of the processes involved.

47514 (LA-UR—85-2994) **Reactive scattering in the bending-corrected rotating linear model.** Walker, R.B.; Hayes, E.F. (Los Alamos National Lab., NM (USA); National Science Foundation, Washington, DC (USA). Controller's Office). 1985. Contract W-7405-ENG-36. 30p. (CONF-8506109—2). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85017539.

From NATO workshop on chemical reactions in inorganic and organic constrained systems; Orleans, France (23 Jun 1985).

We review the theory and applications of the Bending-Corrected Rotating Linear Model (BCRLM) to problems in the quantum description of reactions between atoms and diatomic molecules. 110 refs.

47515 (LBL—18953) **Wobbler facility for biomedical experiments at the Bevalac.** Chu, W.T.; Curtis, S.B.; Llacer, J.; Renner, T.R.; Sorensen, R.W. (Lawrence Berkeley Lab., CA (USA)). May 1985. Contract AC03-76SF00098. 6p. (CONF-850504—276). NTIS, PC A02/MF A01; GPO Dep. File Number DE85017641.

From Particle accelerator conference; Vancouver, Canada (13 May 1985).

A new wobbler facility has been developed to deliver large uniform fields of relativistic heavy ions at the Bevalc without resorting to the use of scattering material in the beam. The charged particle beams are made to wobble and 'paint' a ring at the target by a pair of dipole magnets, which are placed tandem with their fields orthogonal to each other. The magnets are powered sinusoidally 90° out of phase with each other. By superimposing several rings of appropriate sizes and intensities, large uniform fields are produced. Up to 30 cm diameter fields with less than 5% variation in uniformity have been achived. Physics and biology measurements have been made to characterize the radiation field. 5 refs., 4 figs., 1 tab.

47516 (LBL—18963) **Metal vapor vacuum arc (MEVVA) high current ion source.** Brown, I.G. (Lawrence Berkeley Lab., CA (USA)). May 1985. Contract AC03-76SF00098. 7p. (CONF-850504—275). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85017642.

From Particle accelerator conference; Vancouver, Canada (13 May 1985).

An ion source is described in which a metal vapor vacuum arc is used to create the plasma from which the ions are extracted. Beams of a variety of ions have been produced, ranging from lithium up to uranium. At an extraction voltage of 25 kV we've measured an ion beam current of over 1 Ampere, with over 550 ema of the beam in an emittance of $0.07\pi$ cm. mradians (normalized). The ion charge state distribution varies with cathode material and with arc power; for uranium a typical distribution is peaked at $U^{8+}$, with up to 40% of the beam current in this charge state. 27 refs., 10 figs.

47517 (LBL—19875) **Vibrational frequencies of small metal clusters. The beryllium tetramer.** Murphy, R.; Schaefer, H.F. III. (Lawrence Berkeley Lab., CA (USA)). May 1985. Contract AC03-76SF00098. 11p. (CONF-841276—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85016632.

From The Hawaii Nobel Laureate symposium; Honolulu, HI, USA (16 Dec 1984).

The structure and harmonic vibrational frequencies of $Be_4$ have been predicted using ab initio molecular electronic structure theory. A better than double zeta plus polarization (DZ+P) basis set was used in conjunction with self-consistent-field (SCF) and configuration interaction (CI) methods. The predicted frequencies (SCF followed by CI in parentheses) are $a_1$ 651 (680), $t_2$ 576 (589), and e 489 (487) $cm^{-1}$, respectively. 31 refs., 2 tabs.

47518 (LBL—19884) **New experiments on few-electron very heavy atoms.** Gould, H. (Lawrence Berkeley Lab., CA (USA)). Jul 1985. Contract AC03-76SF00098. 17p. (CONF-8505189—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85016633.

From Atomic theory workshop on relativistic and QED effects in heavy atoms; Gaithersburg, MD, USA (23 May 1985).

New experiments, to test quantum electrodynamics (QED) in strong Coulomb fields and to study atomic collisions at ultrarelativistic energies, are proposed. A 0.1% measurement of the $2^3P$/sub 1/2/-$2^3S$/sub 1/2/ splitting in lithium like uranium (Z=92) and the $2^3P_0$ - $2^3S_1$ splitting in heliumlike uranium is proposed as a sub 1% test of the Lamb shift in a strong Coulomb field. Measurements of the hyperfine splitting of hydrogenlike thallium (Z=81) and the g/ sub j/ factor of the ground state of hydrogenlike uranium are propsed as a test of the QED contribution to the magnetic moment of an electron bound in a strong Coulomb field. Measurements of capture cross sections for ultra relativistic very heavy nuclei are proposed to look for the capture of electrons from pair production. 40 refs., 7 figs., 2 tabs.

**47519 (LUNFD6/TFME—1010/1-96(1984)) Studies of density functional methods for finite and extended electron systems.** Pedroza, A.C. (Lund Univ. (Sweden). Dept. of Theoretical Physics). Nov 1984. 13p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85702052.

In this thesis approximate density-functional (DF) schemes have been studied. The exact DF effective potential and orbital eigenvalues have been obtained for the first time for a number of atomic systems and compared with their approximate counterparts. A general finding is that the exact DF eigenvalues lie above the corresponding excitation energies for deeper shells and below the excitation energies for unoccupied shells. However, the differences between the true DF eigenvalues and the corresponding excitation energies were found to be smaller than the error in the local-density (LD) approximation to the DF eigenvalues. Non-local approximations by Langreth, Perdew, and Mehl (LPM) and by Gunnarsson and co-workers have been tested and were found to substantially improve the total energies compared to the LD approximation but to give less improvements for the DF potential and DF eigenvalues. As a further test of the LPM scheme the beryllium metal has been studied, and the calculated cohesive energy and structure factor have been compared with experiments and with results from the LD approximation.

**47520 Isomerically selective photoionization of mercury-197.** Dyer, P.; Baldwin, G.C.; Sabbas, A.M.; Kittrell, C.; Schweitzer, E.L.; Abramson, E.; Imre, D.G. (Physics Division, Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Journal of Applied Physics;* **58**: No. 7, 2431-2436(1 Oct 1985).

We report the second of a series of experiments on selective photoionization of mercury isotopes in which we show that radioactive atoms containing either isomeric form of the radionuclide $^{197}$Hg can be selectively ionized in the presence of natural mercury isotopes by doubly resonant three-step laser photoionization, and discuss its implications as a test case for nuclear-isomer separation.

**47521 Comparison of the reactive sudden and adiabatic BCRLM approximations for rotationally averaged cross sections.** Walker, R.B.; Pollak, E. (Theoretical Division, T-12, MS J569, Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Journal of Chemical Physics;* **83**: No. 6, 2851-2856(15 Sep 1985).

The large differences between sudden and adiabatic approximate reactive cross sections are removed by rotationally averaging the bending corrected rotating linear model (BCRLM) cross sections and by shifting the sudden cross sections by the zero point bend energy at the transition state. For D + $H_2$(n = 0) we find that the BCRLM rotationally averaged rate constants are in excellent agreement with experiment. For D + $H_2$(n = 1), the BCRLM rates are a factor of 6—10 smaller than the most recent experimental values.

**47522 Evidence from alkali-metal-atom transition probabilities for a phenomenological atomic supersymmetry.** Kostelecky, V.A.; Nieto, M.M. (Theoretical Division, Los Alamos National Laboratory, University of California, Los Alamos, New Mexico 87545). *Physical Review [Section] A: General Physics;* **32**: No. 3, 1293-1298(Sep 1985).

We review the proposal that relationships between physical spectra of certain atoms can be considered as evidence for a phenomenological supersymmetry. Next, a comparison is made between the supersymmetric and the hydrogenic approximations. We then present the calculation of low-Z alkali-metal-atom transition probabilities between low-n states, using supersymmetric wave functions. These probabilities agree more closely with accepted values than do those obtained with use of the hydrogenic approximation. This shows that, in simple radial Schroedinger theory, supersymmetry is a concept providing insight into the true, fermionic, many-body physics of these atoms.

**47523 Lifetime measurements of core-excited quartet levels in Na I.** Engstroem, L.; Young, L.; Somerville, L.P.; Berry, H.G. (Physics Division, Argonne National Laboratory, Argonne, Illinois 60439). *Physical Review [Section] A: General Physics;* **32**: No. 3, 1468-1471(Sep 1985). Contract W-31-109-ENG-38.

In a recent spectroscopic study [D. E. Holmgren et al., Phys. Rev. A 31, 677 (1985)], many metastable core-excited quartet levels in Na I have been identified, and based on calculated decay rates (both radiative and autoionizing) some of these levels have been suggested for use in an extreme ultraviolet (xuv) laser. In order to test the theoretical calculations we have used the beam-foil technique to determine experimental lifetimes for eight quartet levels in the core-excited configurations $2p^5 3s3d$ and $2p^5 3s4s$. The agreement between theory and experiment is within a factor of 2, but with systematic discrepancies.

**47524 Relativistic cross sections for atomic K- and L-shell ionization by protons, calculated from a Dirac—Hartree—Slater model.** Chen, M.H.; Crasemann, B. (Lawrence Livermore National Laboratory, University of California, Livermore, California 94550). *Atomic Data and Nuclear Data Tables;* **33**: No. 2, 217-234(Sep 1985). Contract W-7405-ENG-48.

Relativistic direct ionization cross sections for proton impact have been computed for atomic K and L shells, with Dirac—Hartree—Slater wave functions. Corrections for binding, polarization, and Coulomb deflection are included. Results are tabulated for proton energies from about 0.1 to 3 MeV, for 27 elements with atomic numbers 22< or =Z< or =92.

**47525 Multiple photon processes in tantalum resonance ionization mass spectrometry.** Nogar, N.S.; Downey, S.W.; Miller, C.M. (Los Alamos National Lab., MN). *Analytical Chemistry;* **57**: No. 6, 1144-1147(May 1985).

A variety of three-photon ionization processes have been observed in tantalum. Both 2 + 1 and 1 + 2 (photons to resonance and photons to ionize) processes have been observed with the former producing much more intense signals. Extensive use was made of double resonance methods in order to assign, or partially assign, the wide variety of transitions observed in the spectral region 450-459 nm. Excited states up to ~4000 $cm^{-1}$ above the ground state were observed to have appreciable populations. In addition, a significant quasi-resonant background has been observed. It is proposed that such multiphoton (n ≧ 3) ionization may be useful for chemical analyses and that background (nonresonant) ionization can be minimized by using continuous wave lasers for ionization. 27 references, 1 figure, 1 table.

**47526 Precision measurement of the $^2$Psub(3/2)-$^2$Psub(1/2) fine-structure splitting in hydrogenic iron and zinc using beam-foil spectroscopy.** Hailey, C.J.; Stewart, R.E.; Chandler, G.A.; Dietrich, D.D.; Fortner, R.J. (Lawrence Livermore National Lab., CA). *Journal of Physics B: Atomic and Molecular Physics;* **18**: No. 7, 1443-1448(14 Apr 1985).

The $^2$Psub(3/2)-$^2$Psub(1/2) fine-structure interval in hydrogenic iron and zinc has been determined in a beam-foil spectroscopy experiment. A novel technique utilising a dual-arm Johann spectrometer was used which allowed the measurements to be performed with high precision and high efficiency. The fine-structure splitting was determined to be 21.5 +- 0.4 eV in hydrogenic iron and 38.2 +- 0.8 eV in hydrogenic zinc compared with theoretical values of 21.2 and 37.9 eV, respectively, given by previous workers. The result obtained for iron is in better agreement with theory than the previously reported measurements.

**47527 Angle-resolved photoelectron measurements on the 2p orbitals of Si in $SiF_4$ and $Si(CH_3)_4$ in the gas phase.** Keller, P.R.; Taylor, J.W.; Grimm, F.A.; Senn, P.; Carlson, T.A.; Krause, M.O. (Univ. of Wisconsin, Madison). *Chemical Physics (Amsterdam);* **74**: 247-251(1983). Contract W-7405-ENG-26.

Angle-resolved photoelectron measurements have been carried out on the 2p orbital of Si in the gas-phase molecules $SiF_4$ and $Si(CH_3)_4$ as a function of energy from 3 to 45 eV above the ionization threshold. From these data the angular distribution parameter, $\beta$, has been obtained. Below a photoelectron energy of 15 eV angular distribution parameter for these two molecules differ by as much as 0.4 units. The differences in the behavior of $\beta$ near threshold for the two molecules is attributed to the different molecular environment of the silicon atoms. To test this idea, calculations have been made on $\beta$ for neutral and charged atomic silicon.

## 6404 Fluid Physics

*REFER ALSO TO CITATION(S) 47023, 47901*

**47528 (AD-A—154461/8/XAB) Schottky theory of three-component plasmas. Master's thesis.** Clouse, C.J. (Air Force Inst. of Tech., Wright-Patterson AFB, OH (USA). School of Engineering). Jan 1985. 115p. NTIS, PC A06/MF A01.

The purpose of this study was to analyze and compare papers that give conflicting results concerning the charged-particle profiles in an oxygen discharge tube. Lee predicts proportional negative ion and electron profiles, whereas Thompson and Ingold predict non-proportional profiles. The analytic developments were critically reviewed and numerical solutions were developed for each approach. Ingold's development seemed to be lacking a firm mathematical basis. One of Ingold's fundamental relations used throughout his development could not be established and, furthermore, it was shown that a completely different solution could be developed without introducing additional constraints. Lee's profiles reduce to Thompson's when associative detachment is ignored and a common set of parameters and coordinate system are used. When associative detachment is included, Lee and Thompson do not give similar profiles.

**47529 (AD-A—154464/2/XAB) Angle-averaged Compton cross sections for degenerate electron gases. Master's thesis.** Pochkowski, J.M. (Air Force Inst. of Tech., Wright-Patterson AFB, OH (USA). School of Engineering). Mar 1985. 90p. NTIS, PC A05/MF A01.

Compton scattering in dense electron gases is reviewed. The processes of Compton scattering are incorporated into the development of an analytic expression for the scattering kernel. The kernel is good for electron and photon energies in the keV regime. The kernel is in turn used to compute angle-averaged differential Compton cross sections. The development of this analytic expression for the kernel leads to a decrease of three orders of magnitude in the computational times for the Compton cross sections.

**47530 (DOE/ER/03077—266) Applications of front tracking to combustion, surface instabilities and two dimensional Riemann problems: a conference report.** Bukiet, B.; Gardner, C.L.; Glimm, J.; Grove, J.; Jones, J.; McBryan, O.; Menikoff, R.; Sharp, D.H. (New York Univ., NY (USA). Courant Mathematics and Computing Lab.; Los Alamos National Lab., NM (USA)). Aug 1985. Contract W-7405-ENG-36;AC02-76ER03077. 29p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85017393.

The method of front tracking is applied to problems involving curved detonation fronts, surface instabilities and two-dimensional Riemann problems. The detonation problems include detonation fronts with and without cylindrical symmetry; comparisons with one-dimensional models are made. The analysis of interface instabilities focuses on the compressible Rayleigh-Taylor instability of a supersonic accelerated contact discontinuity between two gases and the propagation of a supersonic slab jet. Theoretical notions for an S matrix theory for general multi-dimensional hyperbolic conservation laws and the numerical implementation of computer programs which solve certain two-dimensional Riemann problems are also discussed.

**47531 (SAND—85-8215) TOPAZ - the transient one-dimensional pipe flow analyzer: user's manual.** Winters, W.S. (Sandia National Labs., Livermore, CA (USA)). Jul 1985. Contract AC04-76DR00789. 54p. NTIS, PC A04/MF A01; GPO Dep. File Number DE85017424.

TOPAZ is a "user friendly" computer code for modeling the one-dimensional-transient physics of multi-species gas transfer in arbitrary arrangements of pipes, valves, vessels, and flow branches. This document serves as a user's manual for the code, and should provide potential users with enough information to take advantage of many of the code's capabilities. Details regarding equations and numerics, example problems, applications, and modeling assumptions will be discussed in companion documents.

**47532 (UCID—20507) Diffusion in binary plasma mixtures.** Boercker, D.B.; Ladd, A.J.; Pollock, E.L. (Lawrence Livermore National Lab., CA (USA)). 16 Aug 1985. Contract W-7405-ENG-48. 15p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85017694.

This report considers ion diffusion in binary plasma mixtures. After first defining the diffusion coefficient for a binary mixture, we show how it is related to concentration fluctuations. The relation between diffusion and self diffusion is discussed. Specializing to a model of classical ions in a uniform, charge neutralizing, background we discuss molecular dynamics simulations and kinetic theory calculations. Results for $H^+$-$He^{++}$ mixtures at a temperature of 5 eV and $Si^{+14}$-$Sr^{+38}$ mixtures at 1 keV, all at $10^{23}$ ions/cm$^3$, are presented and discussed. 8 refs., 1 tab.

**47533 Fast turbulent correlations from phase coherence velocimetry.** Johnson, J.A. III; Chen, S.; Johnson, L.E. (Department of Physics, The City College, City University of New York, New York, New York 10031). *Review of Scientific Instruments;* **56**: No. 9, 1831-1832(Sep 1985). Contract AC02-83ER13044.

Flows with coherent structures allow see-free measurements of local velocity and velocity fluctuations. Continuous turbulent velocity histories in ionizing shock waves are obtained at a 10-MHz sampling rate. From this, correlation profiles and frequency spectra are determined which reveal the presence of prominent high-frequency components.

**47534 Analysis of freeze coating on a nonisothermal moving plate by a perturbatio method.** Cheung, F.B. (Reactor Analysis and Safety Division, Argonne National Laboratory, Argonne, IL 60439). *Journal of Heat Transfer;* **107**: No. 3, 549-556(Aug 1985).

The behavior of a frozen layer (or "freeze coat") on the surface of a chilled flat plate traveling with a constant velocity through a warm liquid bath is studied analytically. A perturbation technique is employed to solve the equations governing the shape and temperature of the freeze coat, taking full account of the axial variation of the plate temperature and heat convection from the warm liquid to the moving object. Unlike the case of an isothermal plate where the freeze-coat thickness increases monotonically along the axial direction, here the freeze coat is found to grow only within a limited distance from the inlet. Beyond this distance, the freeze coat begins to decay through remelting. The location at which remelting occurs and the maximum freeze-coat thickness are determined displaying the principal effects of three controlling dimensionless parameters. Criteria for selection of the optimum freeze-coating operation conditions are established and discussed.

## 6450 High Energy Physics

*REFER ALSO TO CITATION(S) 47472, 47655*

**47535 (FNAL/C—85/94) Fermilab advanced computer program multi-microprocessor project.** Nash, T.; Areti, H.; Biel, J.; Case, G.; Cook, A.; Fischler, M.; Gaines, I.; Hance, R.; Husby, D.; Zmuda, T. (Fermi National Accelerator Lab., Batavia, IL (USA)). Jun 1985. Contract AC02-76CH03000. 11p. (CONF-8506157—3). NTIS, PC A02/MF A01; GPO Dep. File Number DE85015817.

From Conference on computing in high energy physics; Amsterdam, Netherlands (25 Jun 1985).

Fermilab's Advanced Computer Program is constructing a powerful 128 node multi-microprocessor system for data analysis in high-energy physics. The system will use commercial 32-bit microprocessors programmed in Fortran-77. Extensive software supports easy migration of user applications from a uniprocessor environment to the multiprocessor and provides sophisticated program development, debugging, and error handling and recovery tools. This system is designed to be readily copied, providing computing cost effectiveness of below $2200 per VAX 11/780 equivalent. The low cost, commercial availability, compatibility with off-line analysis programs, and high data bandwidths (up to 160 MByte/sec) make the system an ideal choice for applications to on-line triggers as well as an offline data processor.

47536 **(KMU-HEP—84-08) Proceedings of the 15. Spring Symposium on High Energy Physics.** (Karl-Marx-Universitaet, Leipzig (German Democratic Republic). Sektion Physik). Jun 1984. 107p. (CONF-8403194—). NTIS (US Sales Only), PC A06/MF A01. File Number DE85781587.

From 15. spring symposium on high energy physics; Georgenthal, German D.R. (26 Mar 1984).

Abstracts of individual items from the symposium were prepared separately for the data base. (GHT)

47537 **(LA-UR—85-2443) Anti-matter propulsion: feasibility, status, and possible enhancement.** Howe, S.D. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 13p. (CONF-8506149—3). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85015716.

From Manned mars mission workshop; Huntsville, AL, USA (10 Jun 1985).

The possible use of advanced propulsion techniques must be considered if the currently envisioned launch date of the Manned Mars Mission were to be delayed until 2020 or later. Within the next 30 years, technological advances may allow such methods as beaming power to the ship, inertial-confinement fusion, or mass-conversion of anti-protons to become feasible. Of the possible methods, the anti-proton (anti p), reaction offers the highest potential, the greastest problems, and the most fascination. An Isp of 5000 s would allow the currently envisioned ship to fly to Mars in 3 months and would require about one million pounds to be assembled in Earth orbit. Anti-protons are currently being produced in the world in amounts of about $10^{14}$ particles per year. With sufficient effort, almost a mg/yr ($6 \times 10^{20}$) could be produced by the early 2000s. Current experiments plan to decelerate and capture about $10^{10}$ or greater anti-protons in an electrostatic Penning trap. Such traps may provide a source of low energy anti p's for development of better storage mechanisms suitable for propulsion. Recently, proposals have been investigated which would amplify the average energy released per anti p used. The proposals entail using the anti p's to produce inertial confinement fusion of a capsule or to produce negative muons which can catalyze fusion. By increasing the energy released per anti p, the effective specific cost, $/joule, can be reduced to attractive levels. These two proposals and other areas of research can be investigated now and will help in assessing the feasibility of an anti p engine.

47538 **(SLAC-PUB—3705) Status of networking for high energy physics in the United States.** Kunz, P.F. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Jun 1985. Contract AC03-76SF00515. 8p. (CONF-8506157—4). NTIS, PC A02/MF A01; GPO Dep. File Number DE85016503.

From Conference on computing in high energy physics; Amsterdam, Netherlands (25 Jun 1985).

Networks are used extensively for High Energy Physics in the United States. Although the networks have grown in an ad hoc manner with connections typically being made to satisfy the needs of one detector group, they now encompass to large fraction of the US HEP community in one form or another. This paper summarizes the current status and experience with networks.

## 6451 Particle Interactions And Properties - Experimental

*REFER ALSO TO CITATION(S) 47611, 47614, 47690*

47539 **(BNL—36789) Relativistic heavy ion physics.** Hansen, O. (Brookhaven National Lab., Upton, NY (USA)). 1985. Contract AC02-76CH00016. 7p. (CONF-8505166—3). NTIS, PC A02/MF A01; GPO Dep. File Number DE85017522.

From Symposium on nuclear structure; Copenhagen, Denmark (20 May 1985).

In the fall of 1986, beams of heavy ions up to A = 40 at total energies up to E = 225 GeV/nucleon will become available for experiments at CERN (60 and 225 GeV/nucleon) and at Brookhaven (15.5 GeV/nucleon). Future experiments to look for quark confinement are discussed. 9 refs., 3 figs. (GHT)

47540 **(CEA-CONF—7577) Near threshold $\pi 0$ photoproduction in hydrogen.** Audit, G.; Bloch, A.; de Botton, N. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Aug 1984. 2p. (CONF-840789—13). NTIS (US Sales Only), PC A02/MF A01. File Number DE85752160.

From International conference on particles and nuclei; Heidelberg, F.R. Germany (30 Jul 1984).

Published in summary form only.

47541 **(CEA-CONF—7579) Charged pion photoproduction measurement on deuterium and $^3$He in the (1236) region using a quasi-monochromatic photon beam.** Faure, J.L.; Argan, P.; Audit, G. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Aug 1984. 2p. (CONF-840789—12). NTIS (US Sales Only), PC A02/MF A01. File Number DE85752159.

From International conference on particles and nuclei; Heidelberg, F.R. Germany (30 Jul 1984).

Published in summary form only.

47542 **(CEA-N—2420) Search for charmed particles and a study of the production of phi(1020) in $\pi$p Be hadronic collisions at 185 GeV/c.** Zaninotti, S. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France); Paris-11 Univ., 91 - Orsay (France)). Dec 1984. 253p. (In French). NTIS (US Sales Only), PC A12/MF A01. File Number DE85752138.

We have tried to make evident the production of charmed particles and we have studied the production mechanisms of phi(1020) in $\pi^-$ Be hadronic collisions at 185 GeV/c, using an apparatus placed in one of the beam lines of the CERN SPS. No charm signal was seen and we calculate an upper limit for the production. The phi production cross-section and the differential cross-sections integrated on Psub(T) or Xsub(F), are given in an Xsub(F) range of 0.03 to 0.08. One sees that 90% of the phi are produced in association with strange hadrons. A model of strange quarks s anti-s fusion is proposed to explain this phenomenon.

47543 **(CERN-EP—84-101) Direct photon production from negative and positive pions and protons at 200 GeV/c.** Badier, J.; Bardadin-Otwinowska, M.; Bemporad, C.; Berthon, U.; Bienvenu, H.; Boucrot, J.; Bourotte, J.; Burgun, G.; Callot, O.; Charpentier, P. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France); European Organization for Nuclear Research, Geneva (Switzerland); College de France, 75 - Paris; Ecole Polytechnique, 91 - Palaiseau (France); Paris-11 Univ., 91 - Orsay (France). Lab. de l'Accelerateur Lineaire; Istituto Nazionale di Fisica Nucleare, Pisa (Italy)). 15 Aug 1984. 19p. (CONF-840757—36). NTIS (US Sales Only), PC A02/MF A01. File Number DE85901941.

From 22. international conference on high energy physics; Leipzig, German D.R. (19 Jul 1984).

Direct photon production has been studied in the NA3 spectrometer at CERN, using incident negative and positive beams at 200 GeV/c interacting with an isoscalar carbon target. Two differ-

ent triggers have been used; one of them requires the photon conversion. The experiment is sensitive to photons with 2.5 ≦ P/sub T/ ≦ 6 GeV/c and center-of-mass rapidity -0.4 ≦ y* ≦ 1.2. Preliminary results from incident pions and protons are given and compared to previous data. Preliminary results on the $\gamma/\pi^0$ ratio and on the charge asymmetry between $\pi^-$ and $\pi^+$ induced direct photons are presented and discussed in the framework of QCD predictions. 10 refs., 7 figs.

47544 **(CERN-EP—84-112) Recent results from experiments with light ions at the CERN ISR.** Faessler, M.A. (European Organization for Nuclear Research, Geneva (Switzerland)). 29 Aug 1984. 11p. (CONF-8406221—4; CONF-840789—16). NTIS (US Sales Only), PC A02/MF A01. File Number DE85902034.

From 7. international seminar on high energy physics problems, multiquark interactions and quantum chromodynamics; Dubna, USSR (19 Jun 1984).

Recent results from the light-ion runs at the CERN Intersecting Storage Rings (ISR) are shown: the longitudinal momentum distribution of leading protons in $\alpha\alpha$ collisions, the total neutral energy distribution in the central rapidity region, the particle composition at medium-high p/sub T/, and the $\pi^0$ yields as a function of p/sub T/, in the central rapidity region. 22 refs., 5 figs.

47545 **(CERN-EP—85-48) Future of antineutron physics at LEAR.** Bressani, T.; Minetti, B.; Voci, C. (Istituto Nazionale di Fisica Nucleare, Turin (Italy); Istituto Nazionale di Fisica Nucleare, Padua (Italy)). 15 Apr 1985. 9p. (CONF-850152—9). NTIS (US Sales Only), PC A02/MF A01. File Number DE85901960.

From 3. LEAR workshop; Tignes-Savoie, France (19 Jan 1985).

The perspectives of anti n physics at LEAR are discussed. The main physics interest is a careful and complete study of the anti N-N system, especially at low energies where only a few partial waves are involved. The experimental apparatus suited to achieve the above program is described. Finally a short review of other possible measurements with anti n's is given. 21 refs., 5 figs.

47546 **(CERN-EP—85-51) Review of recent ISR results.** Camilleri, L. (European Organization for Nuclear Research, Geneva (Switzerland)). 16 Apr 1985. 20p. (CONF-850278—9). NTIS (US Sales Only), PC A02/MF A01. File Number DE85901957.

From 5. topical workshop on proton-anti-proton collider physics; St. Vincent, Italy (25 Feb 1985).

Recent results from the ISR on pp collisions and p anti p collisions are reviewed and as much as possible compared to similar data obtained at the SPS Collider. 24 refs., 17 figs.

47547 **(CERN-EP—85-53) anti p p annihilation into neutral kaons.** Amsler, C. (European Organization for Nuclear Research, Geneva (Switzerland)). 17 Apr 1985. 6p. (CONF-850152—10). NTIS (US Sales Only), PC A02/MF A01. File Number DE85901956.

From 3. LEAR workshop; Tignes-Savoie, France (19 Jan 1985).

We have observed anti p p annihilation at rest into K/sub S/ K/sub S/ using a hydrogen gas target at normal temperature and pressure. This channel is forbidden from atomic anti p p S states. A preliminary analysis gives a branching ratio of (2.2 +- 0.5 +- 0.5) x $10^{-5}$. We have also observed the channel K/sub S/X where X is a K/sub S/ or K/sub L/ escaping detection in our apparatus. The K/sub S/K/sub L/) mode is allowed from atomic S but forbidden from atomic P orbitals. Using the known branching ratio of (7.8 +- 0.4) x $10^{-4}$ for anti p p → K/sub S/K/sub L/ and our preliminary figure of (3.8 +- 0.4 +- 0.8) x $10^{-4}$ for K/sub S/X we deduce that the fraction of S state annihilation in hydrogen gas at NTP is (46 +- 10)%. This in turn yields an absolute branching ratio of (4.1 +- 0.9 +- 1.0) x $10^{-5}$ for anti p p → K/sub S/K/sub S/ from P orbitals, showing that the (K/sub S/K/sub S/ + K/sub L/K/sub L/) mode is suppressed by an order of magnitude compared to the K/sub S/K/sub L/ mode. 6 refs., 6 figs.

47548 **(CERN-EP—85-65) Status and future of experiment PS185 (anti pp → anti YY) at CERN.** Barnes, P.D.; Besold, R.; Birien, P.; Bonner, B.; Breunlich, W.; Dutty, W.; Eisenstein, R.A.; Ericsson, G.; Eyrich, W.; Frankenberg, R. (Carnegie-Mellon Univ., Pittsburgh, PA (USA); Erlangen-Nuernberg Univ., Erlangen (Germany, F.R.); CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Physique Nucleaire; Los Alamos National Lab., NM (USA); Oesterreichische Akademie der Wissenschaften, Vienna; Freiburg Univ. (Germany, F.R.)). 2 May 1985. 7p. (CONF-850152—12). NTIS (US Sales Only), PC A02/MF A01. File Number DE85901949.

From 3. LEAR workshop; Tignes-Savoie, France (19 Jan 1985).

The LEAR Experiment PS185 at CERN measures total and differential cross-sections as well as polarizations and spin correlations in the reaction anti pp → anti YY. The aim is to try to isolate the dynamics of the strange anti ss quark pair from the anti YY observables. Data were taken for the first time in May 1984 at two anti p momenta (1477 and 1508 MeV/c), and some results from a preliminary evaluation are discussed. The forthcoming program of PS185 is outlined together with a discussion of physics questions that can be addressed within the framework of this experiment. 22 refs., 4 figs., 2 tabs.

47549 **(CERN-EP—85-82) Is KNO-scaling dead.** Ekspong, G. (European Organization for Nuclear Research, Geneva (Switzerland); Stockholm Univ. (Sweden). Inst. of Physics). 29 May 1985. 10p. (CONF-850278—7). NTIS (US Sales Only), PC A02/MF A01. File Number DE85901961.

From 5. topical workshop on proton-anti-proton collider physics; St. Vincent, Italy (25 Feb 1985).

A new empirical regularity for charged particle multiplicity distributions in place of KNO scaling is presented. 14 refs., 6 figs.

47550 **(CONF-8408168—1) Glueballs of QCD and beyond.** Lindenbaum, S.J. (Brookhaven National Lab., Upton, NY (USA); City Coll., New York (USA)). 1984. Contract AC02-79ER10550;AC02-76CH00016. 41p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85016057.

From 22. international school of subnuclear physics on quarks, leptons and their constituents; Erice, Trapani, Sicily (5 Aug 1984).

There are two methods discussed by which glueballs might be found. In the first, an OZI suppressed channel with variable mass is used, such as the reaction $\pi^- p \rightarrow$ phi phi n. The breakdown of the OZI suppression is the glueball signal. The OZI suppression is a filter letting glueballs pass while strongly rejecting conventional hadronic states. The other method is to look in a channel enriched in gluons such as the radiative decay of the J/psi and search for new phenomena, such as the iota(1440), the $\theta(1640)$, and the zeta(2220). It is anticipated that the next step in nested gauge-gauge groups might be some new strong color interaction conceptually similar to hypercolor, technicolor, or extended technicolor. 43 refs., 13 figs. (LEW)

47551 **(DESY—85-020) Measurement of the decay Y(2S) -> $\pi\pi$Y(1S).** Gelphman, D.; Bloom, E.D.; Clare, R.; Cooper, S.; Gaiser, J.; Godfrey, G.; Hofstadter, R.; Kirkbride, I.; Lee, R.; Leffler, S. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Mar 1985. Contract AC03-76SF00515. 26p. (SLAC-PUB—3563). NTIS (US Sales Only), PC A03/MF A01. File Number DE85752322.

We have investigated the hadronic transitions Y(2S) -> $\pi^0\pi^0$Y(1S) -> $\gamma\gamma\gamma l^+l^+$ (l=$\mu$ or e) and Y(2S) -> $\pi^+\pi^-$Y(1S) -> $\pi^+\pi^- e^+e^-$ using the Crystal Ball detector at the DORIS II $e^+e^-$ storage ring. Using the present world average value of Bsub($\mu$)(Y(1S)) = (2.9 +- 0.3)% we derive branching ratios B(Y(2S) -> $\pi^0\pi^0$ Y(1S)) = (8.0 +- 1.5)% and B(Y(2S) -> $\pi^+\pi^-$Y(1S)) = (16.9 +- 4.0)%. We also present results on the invariant mass spectra and the angular distributions of the di-pion system.

**47552 (DOE/ER/01195—T7) Forward charge flow in hadronic J/psi production.** Li, W.G. (Illinois Univ., Urbana (USA). Dept. of Physics). 1985. Contract AC02-76ER01195. 142p. (COO—1195-499). NTIS, PC A07/MF A01; GPO Dep. File Number DE85016191.

Thesis.

The properties of the forward charge of J/psi production are examined. The rapidity distribution of the forward charge, the dependence of the forward charge as a function of J/psi Xf and as a function of the effective energy of the forward hadron system are presented. The forward charge of J/psi production is compared with those of omega production and in the inclusive interactions. The forward charge is consistent with the prediction from simple parton fusion model.

**47553 (DOE/ER/03509—21) [Elementary particle physics]. Progress report, August 1, 1984-July 31, 1985.** Lannutti, J.E. (Florida State Univ., Tallahassee (USA). Dept. of Physics). 1985. Contract AS05-76ER03509. 107p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE85016901.

Data-taking is reported in an experiment studying high P/sub t/ one- and two-particle inclusive production. E/iota events have been observed from $\pi^-$p and antipp. The Cabbibo-suppressed decay D→phi $\pi$, K/sup */0(2060)→phiK$\pi$, and forward K/sup */(892) production have been observed, as well as various modes of production and decay of strange baryons. Analysis of an experiment on high P/sub t/ jets and dimuon production is reported as continuing. A large part of the theoretical work reported has been in the area of perturbative QCD calculations, with much of the emphasis being aimed at topics relevant to existing or proposed colliders. The recent creation of the Supercomputer Computations Research Institute (SCRI) has opened up new possibilities in this area. Investigations into Monte Carlo simulations of field theoretic models have been started. 39 refs. (LEW)

**47554 (IFVE-OEIPK—84-73) Inclusive production of baryon resonances in $K^+$p interactions at 32 GeV/c.** Knyazev, V.V.; Tomaradze, A.G.; Uvarov, V.A.; Fenyuk, A.B.; Chikilev, O.G.; Shlyapnikov, P.V.; Vol'f, E.A.; Amaglobeli, N.S. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1984. 32p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. File Number DE85702096.

Submitted to the journal Sov. J. Nucl. Phys. .

Results on total inclusive, semi-inclusive cross sections and inclusive spectra of the $\Sigma^{*+-}$(1385), anti $\Sigma^{*+-}$(1385) and $\Delta^{++}$(1232) obtained in 32 GeV/c $K^+$p experiment with the bubble chamber Mirabelle are presented. Associated production of the $\Sigma^{*+-}$ (1385) with slow protons is studied for the first time. Experimental data are compared in details with the Lund fragmentation model. The first experimental estimates of parameters describing suppression of spin 1 sea diquarks relative to spin 0 diquarks and of strange sea diquarks relative to nonstrange ones are obtained.

**47555 (IHEP-HD—84-08) Study of hadronic transitions between Y' and Y with the ARGUS-detector.** Heller, R. (Heidelberg Univ. (Germany, F.R.). Inst. fuer Hochenergiephysik; Heidelberg Univ. (Germany, F.R.). Naturwissenschaftlich-Mathematische Gesamtfakultaet). Sep 1984. 118p. (In German). Library of Heidelberg Univ., Germany, F.R.

The hadronic transitions between the banti b mesons Y' and Y are a tool to test models based on Quantum Chromo-Dynamics (QCD) which describe these transitions by the emission of E1E1- and E1M1-gluons. The gluons fragment into light mesons, like two pions or an eta. The exclusive decays Y' -> $Y\pi^+\pi^-$ -> $e^+e^-\pi^+\pi^-$ / $\mu^+\mu^-\pi^+\pi^-$ and Y' -> $Y\pi^0\pi^0$ -> $e^+e^-\pi^0\pi^0$ / $\mu^+\mu^-\pi^0\pi^0$ are measured using the ARGUS detector at the $e^+e^-$storage ring DORIS II at DESY in Hamburg. The branching ratios of Y' -> $Y\pi^0\pi^0$, Y -> $e^+e^-$, Y -> $\mu^+\mu^-$ and the $\pi\pi$ mass spectrum as well as all decay angular distributions of Y' -> $Y\pi^+\pi^-$ are determined. In addition an upper limit for the branching ratio of Y' -> Yeta is given with 90% confidence. $\pi^0$ and eta detection require good measurement of photon energies over a long time. An essential part for the stability control is a laser monitor-system which is described in detail. The branching ratio of the decay Y' -> $Y\pi^0\pi^0$ indicates - together with the corresponding value of Y' -> $Y\pi^+\pi^-$ - that the Y' and the Y have isospin 0. The $\pi\pi$ mass spectrum is peaking at high masses. The angular distributions of the $\pi\pi$ system and of the $\pi^+$ are compatible with the assumption that the $\pi\pi$ system is emitted in an s-wave. The angular distribution of the final lepton shows that the Y is in the same polarisation state as the produced Y after emission of the two pions. All these results are in agreement with QCD. Comparing the $\pi\pi$ mass spectrum to the corresponding one in phi' -> J/phi$\pi\pi$, one observes a significant difference in shape. This was predicted in one QCD model as an effect of the running coupling constant $\alpha$sub(s).

**47556 (INIS-mf—9351, pp 584-591) Beta decay of polarized neutrons.** Bopp, P.; Dubbers, D.; Hornig, L.; Klemt, E.; Last, J.; Schuetze, H.; Freedman, S.J.; Schaerpf, O. (Heidelberg Univ., Germany, F.R.). 1984. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781594. (CONF-8409143—).

From 7. international conference on atomic masses and fundamental constants (AMCO-7); Darmstadt-Seeheim, F.R. Germany (3 Sep 1984).

Beta decay of polarized neutrons has been studied with the superconductive spectrometer PERKEO at the Institut Laue-Langevin. The energy spectrum of the $\beta$-decay asymmetry has been measured for the first time; from the absolute value of the asymmetry we obtain a new value for the ratio of weak coupling constants gsub(A)/gsub(V), which is compared to similar data from hyperon decays. The measurement of further weak interaction parameters from neutron decay is in progress. (orig.).

**47557 (INIS-mf—9351, pp 638-645) Double beta decay and the neutrino restmass.** Kirsten, T. (Max-Planck-Institut fuer Kernphysik, Heidelberg, Germany, F.R.). 1984. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781594. (CONF-8409143—).

From 7. international conference on atomic masses and fundamental constants (AMCO-7); Darmstadt-Seeheim, F.R. Germany (3 Sep 1984).

Double Beta Decay experiments provide a definite upper limit for the electron neutrino restmass of m sub($\nu$sub(e)) <= 9 eV (95% confidence). By adding a rather reasonable assumption, the limit is further restricted to m sub($\nu$sub(e)) <= 5.7 eV (95% confidence). (orig.).

**47558 (INIS-mf—9351, pp 646-651) Experiment to measure the electron anti-neutrino mass from the $\beta$ decay of $^3$H.** Graham, R.L.; Lone, M.A.; Andrews, H.R.; Gallant, J.L.; Geiger, J.S.; Lee-Whiting, G.E. (Atomic Energy of Canada Ltd., Chalk River, Ontario. Chalk River Nuclear Labs.); Audi, G. (Centre National de la Recherche Scientifique, 91 - Orsay (France). Lab. Rene Bernas). 1984. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781594. (CONF-8409143—).

From 7. international conference on atomic masses and fundamental constants (AMCO-7); Darmstadt-Seeheim, F.R. Germany (3 Sep 1984).

We report here on the present status of our work on source design and preparation and on the proportional counter detector array which is under construction. Simulations are presented of predicted instrumental line shapes, including second order aberrations, when using an extended source and a multi-detector system. (orig.).

**47559 (JINR—1-84-457) Investigation of hadronic production and properties of charmed particles and narrow baryon resonances at the Serpukhov accelerator (physical basis of CHARM project). Main results obtained at BIS-2 spectrometer.** Govorun, N.N.; Grigalashvili, T.S.; Gus'kov, B.N. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1984. 16p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE85702097.

A review is given of the main results obtained by means of the BIS-2 spectrometer (JINR) in a neutron beam of the Serpukhov accelerator. All results have been published in 1980-1984. The production of charmed baryons Asub(c)sup(+), and $\Lambda$ has been observed. The anti K + $p^+$ +$p^-$ decay mode has been observed for

the first time. The dynamics of the production process has been studied, and the production cross section Asub(c)sup(+) has been measured. An unknown narrow baryon resonance has been observed in the $\Sigma^-(1385)K^+$ system. Its mass is 1956sub(-0)sup(+8) and its width- 27 +- 15 MeV. The results on hyperon and antihyperon production by neutrons, including the diffraction and coherent dissociation $n \rightarrow \Lambda^0 K^0$, and on $\Lambda^0$ polarization are also presented.

47560 **(JINR—E-1-84-515) Single spectrometer station for neutrino-tagging.** Nedyalkov, I.P. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation). 1984. 12p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85702219.

A neutrino tagging station built with respect to the following scheme is proposed. A beam of muons and kaons passes through a magnetic spectrometer, where the energy of each particle is measured. There are coordinate detectors behind the spectrometer in several planes, where the direction of the trajectory of a given particle is determined. Thus, mesons enter the decay point wth the known 4-momentum. Behind the decay point the direction of $\mu$-meson generated by the decay of parent mesons is measured. It is shown that information is sufficient for determining the kind of parent particle (pion or kaon), the energy and the direction of trajectory of the neutrino.

47561 **(LA-UR—85-2346) Study of rare muon decay modes with the crystal box.** Sandberg, V.; Bolton, R.D.; Bowman, J.D.; Carlini, R.D.; Copper, M.D.; Doung-Van, M.; Frank, J.S.; Hallin, A.L.; Heusi, P.; Hoffman, C.M. (Los Alamos National Lab., NM (USA); Chicago Univ., IL (USA); Stanford Univ., CA (USA); Temple Univ., Philadelphia, PA (USA)). 1985. Contract W-7405-ENG-36. 43p. (CONF-850414—1). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85015678.

From General meeting of the American Physical Society; Washington, DC, USA (25 Apr 1985).

We report on a search for the lepton family-number-nonconserving decays $\mu^+ \rightarrow e^+ e^- e^+$, $\mu^+ \rightarrow e^+ \gamma$, and $\mu^+ \rightarrow e^+ \gamma\gamma$, using the Crystal Box detector at LAMPF. The experiment was run in the stopped muon channel at LAMPF during the winter and summer of 1984. Muons were stopped in the middle of a detector system consisting of a cylindrical drift chamber, a plastic scintillator hodoscope, and a segmented array of sodium iodide crystals. The sodium iodide surrounded the hodoscope and drift chamber. Events consistent with any of the above decays were recorded. The off-line data analysis imposed requirements on the timing, vertex location, and energy and momentum conservation for each event. Radioactive sources, conventional muon decay spectra, and photons from the process $\pi^- p \rightarrow n\gamma$ and $\pi^- p \rightarrow n\pi^0$ were used to provide energy calibration and resolution estimates. The inner bremsstrahlung processes $\mu^+ \rightarrow e^+ \gamma\nu\text{antin}\nu$ and $\mu^+ \rightarrow e^+ e^- e^+ \nu\text{antin}\nu$ were observed at the expected rates. Details of the detector, the data analysis, and our latest bounds for the branching ratios will be presented. 33 figs.

47562 **(PITHA—82/24) Further evidence for the radiative decay of a light, penetrating particle.** Faissner, H.; Heinrigs, W.; Preussger, A.; Samm, D. (Technische Hochschule Aachen (Germany, F.R.). Lehrstuhl fuer Experimentalphysik 3B und 3. Physikalisches Inst.). Dec 1982. 16p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85752315.

Photons and photon pairs from the 590 MeV proton beam dump at SIN, have been observed in a counter-triggered thin foil optical spark chamber, placed behind 7.5 m of iron-concrete, and 2 m of free space. A significant excess of events was found at small angles $\alpha$ towards the beam dump direction: thirteen 1$\gamma$-events, and twelve 2$\gamma$-events (with $\alpha <= 7$ deg, and for 129 Coulombs), over a flat background of, respectively, 3.2 and 2.3 events per bin. The effect was unchanged by 20 cm of iron in front of the decay region, but vanished when this iron was moved to the end of that region. This suggests that these photons stem from a dacay.

47563 **(PITHA—84/21) W, Z⁰ and then.** Eggert, K. (Technische Hochschule Aachen (Germany, F.R.). Lehrstuhl fuer Experimentalphysik 3B und 3. Physikalisches Inst.). Aug 1984. 42p. (CONF-8403199—2). NTIS (US Sales Only), PC A03/MF A01. File Number DE85752319.

From International symposium on cosmic ray and particle physics; Tokyo, Japan (19 Mar 1984).

Results of the UA1-Collaboration are presented. The production and decays of the Intermediate Vector Bosons into the electron and muon channels are discussed and compared with the standard model. Special emphasis is given to the unexpected features of the Z⁰-events, in particular the radiative Z⁰-decays and the associated jet activity. In addition to the anomalous Z⁰-events we have also observed an unexplained class of events in which a very large missing transverse energy is accompanied by a single narrow jet or an isolated energetic photon(s).

47564 **(PITHA—84/32) Strange di-muon events at the p anti p-collider.** Eggert, K. (Technische Hochschule Aachen (Germany, F.R.). Lehrstuhl fuer Experimentalphysik 3B und 3. Physikalisches Inst.). Nov 1984. 16p. (CONF-8403199—1). NTIS (US Sales Only), PC A02/MF A01. File Number DE85752318.

From International symposium on cosmic ray and particle physics; Tokyo, Japan (19 Mar 1984).

A sample of di-muons, recorded with the UA1-detector at the CERN anti pp-collider ($\sqrt{s}$=540 GeV), is presented. From a data sample with an integrated luminosity of 108 $nb^{-1}$ 10 di-muons were found with both muons having transverse momenta above 5 GeV/c, excluding 5 Z⁰-events. The events cover a broad spectrum of jet activity, from Drell-Yan like events to some with di-muon-multijet masses above 100 GeV/$c^2$. Some events do not conform to expectations. Emphasis is given to an unusual event with like sign muons that are isolated and have transverse momenta above 10 GeV/c.

47565 **(SLAC—281) Sixth quark: proceedings.** McDonough, P.M. (ed.). (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Jan 1985. Contract AC03-76SF00515. 761p. (CONF-8407112—). NTIS, PC A99/MF A01; 1; GPO Dep. File Number DE85015805.

From 12. SLAC summer institute on particle physics; Stanford, CA, USA (23 Jul 1984).

Separate abstracts were prepared for 34 papers in this conference proceedings. (LEW)

47566 **(SLAC-PUB—3730) Radiative J/psi decays and the pseudoscalar puzzle.** Wermes, N. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Jul 1985. Contract AC03-76SF00515. 22p. (CONF-850785—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85016905.

From 5. international conference on physics in collision; Autun, France (3 Jul 1985).

Recent results on radiative decays of the J/PSI, obtained by the SPEAR detectors Mark III and Crystal Ball and the DCI detector DM2 at Orsay, are presented. The status of the glueball candidates $\theta$(1690), iota(1460), and $\xi$(220), and the decays J/PHI $\rightarrow \gamma$ Vector Vector are reviewed. A coupled channel analysis of iota(1460) decays to K anti K$\pi$, rho rho, $\omega\omega$, and $\gamma$rho is presented which may help to understand the pseudoscalar sector in radiative J/PHI decays. 42 refs., 16 figs.

47567 **Measurements of triple- and double-spin parameters in elastic p-p scattering at 6 GeV/c.** Auer, I.P.; Chalmers, J.; Colton, E.; Giese, R.; Halpern, H.; Hill, D.; Miller, R.; Nield, K.; Sandler, B.; Spinka, H. (High Energy Physics Division, Argonne National Laboratory, Argonne, Illinois 60439). *Physical Review* [*Section*] *D: Particles and Fields;* 32: No. 7, 1609-1629(1 Oct 1985). Contract W-31-109-ENG-38.

Toward the goal of experimentally determining the p-p elastic-scattering amplitudes at 6 GeV/c, we have measured a number of triple- and double-spin correlation parameters over the 't' range between 0.2 and 1.0 (GeV/c)$^2$. These new data permit the first nucleon-nucleon amplitude determination in the multi-GeV energy range. Polarized beams from the Argonne Zero Gradient Synchrotron and polarized targets were utilized. The polarization of the recoil proton was measured with a carbon polarimeter. A total of 14 different spin observables were measured (five spin transfer, four depolarization, and five triple-spin correlation parameters). These have been combined with earlier results, resulting in a data set of

typically 30 measurements of 20 different spin observables for each of six 't' values between 0.2 and 1.0 (GeV/c)$^2$. A solution for the amplitudes has been found at each 't', and comparisons are presented with several different models. The spin-nonflip helicity amplitudes are found to be much larger than the spin-flip amplitudes.

47568 **Λ/sub c/ production from $e^+e^-$ annihilation in the Y energy region.** Bowcock, T.; Giles, R.T.; Hassard, J.; Kinoshita, K.; Pipkin, F.M.; Wilson, R.; Haas, P.; Hempstead, M.; Jensen, T.; Kagan, H. (Harvard University, Cambridge, Massachusetts 02138). *Physical Review Letters;* **55**: No. 9, 923-926(26 Aug 1985).

We have observed Λ/sub c/ baryons in nonresonant $e^+e^-$ annihilation at energies around $\sqrt{s}$ = 10.5 GeV through their decay to $\Lambda\pi^+\pi^+\pi^-$. We measure the branching fraction to be (2.8 +- 0.7 +- 1.1)%. The momentum spectrum of the Λ/sub c/ is similar to that of charmed mesons, providing a constraint on models of charmed-quark hadronization.

47569 **Spin and parity analysis of KK-bar$\pi$ system in the D and E/iota regions.** Chung, S.U.; Fernow, R.; Kirk, H.; Protopopescu, S.D.; Weygand, D.P.; Boehnlein, D.; Goldman, J.H.; Hagopian, V.; Reeves, D.; Crittenden, R. (Brookhaven National Laboratory, Upton, New York 11973). *Physical Review Letters;* **55**: No. 8, 779-782(19 Aug 1985). Contract AS05-76ER03509;AC02-84ER40125.

We have performed a high-statistics experiment on the reaction $\pi^-p\rightarrow K^+K^0\pi^-n$ at 8.0 GeV/c. A Dalitz-plot analysis of the $K^+K^0\pi^-$ system finds that the D(1285) is a J/sup P/G = $1^{++}$ state coupling predominantly to a $\delta\pi$ decay channel, while the E(1420) peak consists mostly of a J/sup P/G = $0^{-+}$ wave with a substantial $\delta\pi$ decay mode. There is little evidence of a $1^{++}$ resonance at the E mass.

47570 **Measurement of the topological branching fractions of the tau lepton.** Akerlof, C.; Baranko, G.; Baringer, P.; Beltrami, I.; Blockus, D.; Bonvicini, G.; Brabson, B.; Bylsma, B.G.; Chapman, J.; Cork, B. (Argonne National Laboratory, Argonne, Illinois 60439; Indiana University, Bloomington, Indiana 47405; University of Michigan, Ann Arbor, Michigan 48109; Purdue University, West Lafayette, Indiana 47907; Lawrence Berkeley Laboratory, Berkeley, California 94720; and Stanford Linear Accelerator Center, Stanford). *Physical Review Letters;* **55**: No. 6, 570-573(5 Aug 1985).

We report new and precise measurements of the decay branching fractions of the tau lepton to one and three charged particles. The data, corresponding to an integrated luminosity of 176 $pb^{-1}$, were collected by the High Resolution Spectrometer at the $e^+e^-$ storage ring PEP at SLAC operated at $\sqrt{s}$ = 29 GeV. The fractions of tau decays into one and three charged particles are 0.869 +- 0.002 +- 0.003 and 0.130 +- 0.002 +- 0.003, respectively.

47571 **Determination of the nucleon structure by means of the weak neutral current.** Bogert, D.; Burnstein, R.; Fisk, R.; Fuess, S.; Morfin, J.; Ohska; Stutte, L.; Walker, J.K.; Bofill, J.; Busza, W. (Fermi National Accelerator Laboratory, Batavia, Illinois 60510). *Physical Review Letters;* **55**: No. 6, 574-577(5 Aug 1985).

An experimental determination of the neutral-current structure functions of the nucleon is obtained by measuring the ratio of the neutral-current x distribution to the charged-current x distribution. The analysis is based on deep-inelastic neutrino-nucleon scattering data gathered in a massive fine-grained neutrino detector exposed to a narrow-band neutrino beam at Fermilab.

47572 **Neutral decays of eta meson.** Aldi, D.; Binon, F.; Brikman, K. (Los Alamos National Lab., NM). *Yadernaya Fizika;* **40**: No. 12, 1447-1453(Dec 1984). (In Russian).

Partial widths of eta-meson decays into $2\gamma$, $3\pi^0$ and $\pi^0\gamma\gamma$ states have been measured with a high statistical and systematical accuracy in the experiment performed at the IHEP accelerator with a hodoscope electromagnetic spectrometer GAMS-2000. An upper limit has been determined for the $3\gamma$ channel. The Dalitz plot for the eta $\rightarrow 3\pi^0$ decay shows that the matrix element does not depend on the pion energy.

47573 **D* and D meson production in $e^+e^-$ annihilation at 29 GeV.** Loos, J.S. (Argonne National Laboratory, Argonne, IL (USA)). pp 293-306 of Proceedings of physics in collision 3., and of the Workshop on search for heavy flavours. Bellini, G.; Bettini, A.; Perasso, L. (eds.). Gif-sur-Yvette, France; Editions Frontieres (1984). (CONF-8308145—).

From Workshop on search for heavy flavors; Como, Italy (29 Aug 1983).

Recent results on D* and D meson production at 29 GeV are presented from the DELCO, HRS and MARK II collaborations at PEP.

47574 **Phenomenology of quark mixing: the b lifetime, CP violation, etc.** Chau, L.L. (Brookhaven National Laboratory, Upton, NY (USA)). pp 281-292 of Proceedings of physics in collision 3., and of the Workshop on search for heavy flavours. Bellini, G.; Bettini, A.; Perasso, L. (eds.). Gif-sur-Yvette, France; Editions Frontieres (1984). (CONF-8308145—).

From Workshop on search for heavy flavors; Como, Italy (29 Aug 1983).

The present status of our knowledge on quark mixing and its phenomenological implications are reviewed. Especially, we report the implications of the recent measurements of the b lifetime and the ratio GAMMAsub(b→u) / GAMMAsub(b→c) on the Kobayashi-Maskawa angles and phase, Ksub(e3) and hyperon decays, CP violation, t-quark masses, $K^0$ <-> anti $K^0$ transition dynamics, $B^0$ - anti $B^0$ mixing and CP violation, and charm and b nonleptonic decay and leptonic productions.

## 6452 Particle Interactions And Properties - Theoretical

*REFER ALSO TO CITATION(S) 47481, 47565, 47574, 47642, 47669*

47575 **(CEA-CONF—7414) New frontiers of electron scattering at intermediate energy.** Frois, B. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Aug 1984. 28p. (CONF-840789—11). NTIS (US Sales Only), PC A03/MF A01. File Number DE85752151.

From International conference on particles and nuclei; Heidelberg, F.R. Germany (30 Jul 1984).

Recent advances in experimental techniques have produced a new generation of electron scattering data. This paper explores the frontiers of this field and shows how our prospects for the future may be modified. Nuclear structure has been determined with an unprecedented accuracy defining clearly the limits of the most advanced theoretical descriptions. Large meson exchange currents are measured quantitatively with precision. Recent data on the electrodisintegration of deuterium at threshold and on the magnetic form factor of $^3$He and tritium show that the pionic exchange current is well understood. There is no satisfactory theoretical description of shorter range processes.

47576 **(CERN-EP—84-96) Hadronic multiplicity distributions and KNO scaling violations.** Pancheri, G. (Istituto Nazionale di Fisica Nucleare, Frascati (Italy). Lab. Nazionale di Frascati). 31 Jul 1984. 20p. (CONF-8406183—12). NTIS (US Sales Only), PC A02/MF A01. File Number DE85901942.

From 15. international symposium on multiparticle dynamics; Lund, Sweden (11 Jun 1984).

Different models describing hadronic multiplicity distributions are reviewed. Recent findings of KNO scaling violations are examined and compared with predictions. 40 refs., 7 figs., 1 tab.

47577 **(CRN-HE—84-03) Possible interaction between spin-1/2 and spin-3/2 fields.** Fleury, N.; Leite Lopes, J. (Strasbourg-1 Univ., 67 (France). Centre de Recherches Nucleaires). 1984. 18p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85752150.

A straightforward extension of the standard Weinberg-Salam model to Rarita-Schwinger formalism is a heuristic way to obtain electroweak currents for spin-3/2 leptons. We postulate a new interaction between spin-1/2 and spin-3/2 particles that maintains

the SU(2) x U(1) gauge invariance, and we obtain a possible form for the interaction involving these two types of particles and the gauge fields. This takes place through a coupling which involves derivatives of the electromagnetic field and the corresponding coupling constant is inversely proportional to the mass of spin-3/2 particles. Several reactions are possible with this new interaction such as the radiative decay of a charged Rarita-Schwinger particle. Other reactions are corrections to well-known processes: for instance, in the usual Compton effect, the fermionic virtual line can be replaced by the corresponding spin-3/2 one. But, due to the large mass of the spin-3/2 lepton, these corrections are significantly non negligible only at ultra relativistic energies. On the other hand, in the low energy limit this correction gives fortunately no contribution to the Thomson cross section because the coupling 3/2-1/2-$\gamma$ is proportional to the photon's momentum. If one considers all the possible couplings of these fields, one can combine them in diagrams of lowest orders whose theoretical predictions have to be submitted to experimental pressure.

47578 **(CRN-HE—84-05) Observation of rotational bands in hadron spectroscopy.** Umezawa, M. (Strasbourg-1 Univ., 67 (France). Centre de Recherches Nucleaires). 1984. 13p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85752148.

A few excellent rotational bands are identified in N and $\Lambda$ mass spectra. They are not multifold and therefore are of a different kind from molecular bands. Apparently the hadronic rotation occurs around the axis perpendicular to the symmetry axis only as in the nucleus. Nevertheless, these rotational bands again differ from nuclear ones because each consists of a series of states of alternating parity.

47579 **(CRN-HE—84-08) Point-counterpoint: theoretical prediction and experimental discovery of elementary particles.** Leite Lopes, J. (Strasbourg-1 Univ., 67 (France). Centre de Recherches Nucleaires). 1984. 31p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85752147.

A report is given on the theoretical prediction and the experimental discovery of elementary particles from the electron to the weak intermediate vector bosons. The work of Lattes, Occhialini and Powell which put in evidence the pions predicted by Yukawa was the starting point of the modern experimental particle physics.

47580 **(CRN-HE—84-09) Possible spin 3/2 quarks in neutrino reactions.** Aguiar, C.E.M.; Lopes, A.L.B.; Martins Simoes, J.A.; Leite Lopes, J. (Strasbourg-1 Univ., 67 (France). Centre de Recherches Nucleaires). 1984. 12p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85752149.

In this paper we discuss the hypothesis that quarks are composite objects and that excited states with spin 3/2 can be produced in neutrino reactions. Experimental consequences are analysed. The most relevant ones are scaling violations of a particular type and a consistent rate for same-sign dileptons.

47581 **(DESY—85-030) Order $\alpha$sub(s)$^2$ two-jet cross section in $e^+e^-$ annihilation.** Lampe, K.; Kramer, G. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Apr 1985. 20p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85752321.

We report results for $e^+e^-$ -> two jets up to order $\alpha$sub(s)$^2$ in the quark-gluon coupling using a jet resolution criterion depending on the jet mass.

47582 **(DESY—85-036) Comparison of 3-jet events with QCD shower models.** Bartel, W.; Becker, L.; Cords, D.; Felst, R.; Haidt, D.; Knies, G.; Krehbiel, H.; Meier, K.; Meinke, R.; Naroska, B. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Apr 1985. 13p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85752325.

Distributions of particles in 3-jet events from $e^+e^-$ -> hadrons are compared with different fragmentation schemes, i.e. the Lund string model, independent parton fragmentation and QCD shower models. Effects specific to the string scheme, which have been seen in the data, are also reproduced by QCD shower models if soft gluon interference effects are included.

47583 **(DOE/ER/40105—480) Proton decay in non-minimal SU(5) GUTs.** Rudaz, S. (Minnesota Univ., Minneapolis (USA). School of Physics and Astronomy). 1984. Contract AC02-83ER40105. 13p. (CONF-8405193—48). NTIS, PC A02/MF A01; GPO Dep. File Number DE85012589.

From Conference on the intersections between particle and nuclear physics; Steamboat Springs, CO, USA (23 May 1984).

We first give an overview of the minimal SU(5) GUT, outlining its successes and failures: we argue that in view of the failure of this theory to reproduce correctly light quark and lepton mass ratios, the lack of experimental evidence for the decay mode $p \rightarrow e^+\pi^0$ is hardly surprising. We then consider non-minimal extensions of the basic SU(5) model, with or without supersymmetry, which give rise to quite different hierarchies of nucleon decay modes. These considerations serve to emphasize the importance of "broad band" searches for proton decay in all possible modes in the next generation of experiments. 31 refs.

47584 **(IFVE-OTF—84-19) Interaction of color objects on large distances.** Arbuzov, B.A.; Boos, Eh.Eh.; Kurennoj, S.S.; Turashvili, K.Sh. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1984. 16p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE85702085.

Submitted to the journal Sov. J. Nucl. Phys. .

The influence of multi-gluon exchanges on the form of the interaction effective potential between colour charges at large distances is considered. It is shown, using the previously obtained infrared asymptotics of the QCD lower Green functions, that both the account for two-gluon exchanges and the asymptotic solution of a model equation lead to the conclusion on the possibility to change the linear growth of the "confinement" potential for the Coulomb decrease at sufficiently large distances. Are discussed the applications of the resUlts obtained to the interpretation of anamalons as states with an explicit colour.

47585 **(IFVE-OTF—84-58) Massless mesons in scalar $QCD_3$.** Klimenko, K.G.; Rcheulishvili, G.L. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1984. 9p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85702086.

Submitted to the journal Theor. Math. Phys. .

The scalar $QCD_3$ is considered in 1/N approximation applying the infrared regularization technique. The expression for a quark propagator is obtained. It is shown that in the case of zero quark masses massless mesons are present in the theory.

47586 **(IFVE-OTF—84-61) Decay chisub(b) → psipsi.** Kartvelishvili, V.G.; Likhoded, A.K. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1984. 8p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85702087.

A new technique for detecting chisub(b)-states based on the decay chisub(b)→phi phi is proposed. The value obtained for the branching ratios (Br) of the decay chisub(b)(0sup(++)) → psi psi is at the Br(0sub(b)sup(++) → psipsi) approximately 3 x $10^{-5}$ level. The calculations were made in the framework of the QCD perturbation theory (the diagrams of the order $\alpha$sub(s)sup(4)). The ratio of the signal to the background is from the continuum of the J/psi meson pairs in hadron-hadron collisions is unity for the resolution in $\Delta$Msub(psi psi) approximately 200 MeV.

47587 **(INIS-mf—9349) Nucleon-nucleon interaction in the framework of the boson exchange model.** Niephaus, G.H. (Bochum Univ. (Germany, F.R.). Abt. fuer Physik und Astronomie). 8 Feb 1984. 251p. (In German). NTIS (US Sales Only), PC A12/MF A01. File Number DE85781591.

Diss. (Dr.rer.nat.).

The aim of this thesis was the description of the nucleon-nucleon interaction in a microscopically founded model. For this the

description of the 2-nucleon problem by an interacting 2-nucleon-pion system was presented. The starting point of our description was a relativistic eigenvalue equation for the system of mesons and two baryons. The interaction of the baryons with the mesons was described by interaction Hamiltonians. By the elimination of antinucleon states by means of a unitary tansformation (Foldy-Wouthuysen transformation) the interaction Hamiltonians for nucleons could be generated for the field-theoretical Lagrangian densities. The Hamiltonians for resonant baryon states were obtained by means of a simplified procedure from the corresponding Lagrangian densities. Because the determination of Lagrangian densities is not unique, for the pion-nucleon coupling two alternative Lagrangian densities were allowed. For the interaction of positive-energy nucleonic states these two coupling yield nearly equal results; the production or annihilation of negative-energy nucleon states (antiparticles) the predictions however are very different. (orig./HSI).

47588 (INIS-mf—9351, pp 564-571) **Corrections to superallowed Fermi $\beta$-decay and the determination of the weak vector coupling constant.** Towner, I.S.; Hardy, J.C. (Atomic Energy of Canada Ltd., Chalk River, Ontario). 1984. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781594. (CONF-8409143—).

From 7. international conference on atomic masses and fundamental constants (AMCO-7); Darmstadt-Seeheim, F.R. Germany (3 Sep 1984).

Superallowed $\beta$-decay data on high-Z nuclei are incompatible with low-Z nuclei. By scaling the errors, we deduce a recommended value for the weak vector coupling constant. Universality with muon, pion and hyperon decays is discussed. (orig.).

47589 (INIS-mf—9351, pp 626-637) **Neutrino masses - their experimental implications.** Simpson, J.J. (Guelph Univ., Ontario, Canada). 1984. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781594. (CONF-8409143—).

From 7. international conference on atomic masses and fundamental constants (AMCO-7); Darmstadt-Seeheim, F.R. Germany (3 Sep 1984).

The author describes the measurement of the neutrino mass by the determination of the $\beta$-endpoint energy in tritium, neutrino oscillations, and the neutrinoless double beta decay. (HSI).

47590 (INIS-mf—9351, pp 381) **Progress of hadron mass calculations in lattice QCD.** Schierholz, G. (Deutsches Elektronen-Synchrotron (DESY), Hamburg, Germany, F.R.). 1984. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781594. (CONF-8409143—).

From 7. international conference on atomic masses and fundamental constants (AMCO-7); Darmstadt-Seeheim, F.R. Germany (3 Sep 1984).

47591 (INIS-mf—9351, pp 382-384) **Simplified scheme for variational calculations of hadronic masses.** Polley, L. (Technische Hochschule Darmstadt, Germany, F.R.). 1984. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781594. (CONF-8409143—).

From 7. international conference on atomic masses and fundamental constants (AMCO-7); Darmstadt-Seeheim, F.R. Germany (3 Sep 1984).

47592 (INIS-mf—9351, pp 392-398) **Nucleons in nuclei in the soliton model to quantumchromodynamics.** Wendel, M.; Hilf, E.R. (Technische Hochschule Darmstadt, Germany, F.R.). 1984. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781594. (CONF-8409143—).

From 7. international conference on atomic masses and fundamental constants (AMCO-7); Darmstadt-Seeheim, F.R. Germany (3 Sep 1984).

In the Soliton model of QCD the gluon field operators are replaced by a classical self-coupling scalar field with a solitontype interaction. The quark wave-functions and the soliton field distribution are calculated for the free nucleon as compared to a nucleon inside nuclear matter simulated by a Wigner-Seitz cell geometry with a spherical boundary condition to simulate the surrounding nucleons. The mass of the nucleon is given in terms of the nuclear-matter density and the model parameters. Application to the gross part of mass formulae are discussed. (orig.).

47593 (INIS-mf—9760) **Proposed interpretation of tau-neutrinos. Predicted masses.** Barricelli, N.A. (Oslo Univ. (Norway). Matematisk Inst.). 1983. 10p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85781592.

Tau-decay is expected to produce, among other particles, also neutral leptons of mass greater than zero, according to the magnetic monopole model presented in several papers. Predicted masses, and criteria for anticipating the formation of such heavy neutral leptons in various tau-decay processes and information which may help detecting them if they are formed, are presented. Because of their long lifetimes such neutral leptons cannot easily be distinguished from neutrinos, if one is not aware of their properties. (Auth.).

47594 (INS—485) **Composite Nambu-Goldstone fermions.** Terazawa, Hidezumi. (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). Dec 1983. 16p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85702095.

The possibility that quarks and leptons are composite Nambu-Goldstone fermions of spontaneously broken supersymmetry is investigated in the minimal subquark model. The formulas for the quark and lepton masses are derived from the partially conserved supercurrent hypothesis and subquark current algebra. They suggest that there may exist excited quarks and leptons whose masses are relatively small (of order 50 GeV).

47595 (INS—486) **Deformable bag model of hadrons, 2.** Saito, Koichi; Ui, Haruo. (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). Jan 1984. 15p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85702088.

The effect of the spheroidal deformation of nucleon on the magnetic moment and the axial vector coupling constant is studied in the MIT bag model with the modified linear boundary condition. When the deformation parameter vartical lambda $^{+}$ is about 0.15, i.e., the ratio of the semiaxes is equal to 1.25, the magnetic moment of the proton changes by some 10 per cent of the MIT value, while the axial vector coupling constant has very small change.

47596 (INS—491) **Differential-difference equation of the Glauber-Lachs and Perina-McGill formula, QCD branching processes and hadronization.** Biyajima, Minoru; Suzuki, Naomichi. (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). Mar 1984. 17p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85702089.

By the use of the Poisson transformation or the method of difference, we obtain a differential-difference equation from the Fokker-Planck equation for the Glauber-Lachs and Perina-McGill formula. It is found that a resulting equation is a same type equation of the QCD branching processes. From solutions in these equations, we can infer possible mechanisms for hadronization: The randomization in stochastic theory seems to be a plausible procedure. Some data (diffractive KNO scaling distribution and that of a single jet in $e^{+}e^{-}$ annihilations) are analysed in our scheme.

47597 (IPNO-TH—84-08) **Nucleon-antinucleon annihilation into two pseudoscalar mesons: quark rearrangement vs. quark annihilation.** Dover, C.B.; Fishbane, P.M. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). Feb 1984. 20p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85752144.

We investigate the interference between planar and rearrangement mechanisms in the quark model for two pseudoscalar annihilation modes of the N anti N system. Both mechanisms seem to be necessary even to partially understand the data.

47598 (ITEF—153(1983)) **Parametrization of invariant cross sections of energetic pion production on nuclei by means of rules of quark counting.** Gerzon, S.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Teoreticheskoj i Ehksperimental'noj Fiziki). 1983. 11p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE85702090.

Parametrization of invariant cross sections of energetic pion production on nuclei by means of the rules of quark counting is discussed. It is shown that experimental data on invariant cross sec-

tions for pA → $\pi^{+-}$x reactions at proton energies of 9 and 400 GeV are well described by functions of the type c(1-x/i)sup(Gi-3) (1+psub(1)sup(2) / msup(2))sup(-4), where x, p, are scale-invariant variables, c, i, $m^2$ are parameters. The results of fitting are presented.

47599 **(ITF—84-43-R) Connection between the quark degrees of freedom and the scattering parameters.** Petrov, N.M. (AN Ukrainskoj SSR, Kiev. Inst. Teoreticheskoj Fiziki). 1984. 17p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE85702091.

The connection between the scattering parameters and parameters of P-matrix description corresponding to the quark degrees of freedom was established. The apparent asymptotic expressions were obtained for the poles of P-matrix and its deductions in these poles. The model of boundary conditions independent of energy was discussed. The model represents the threshold case of P-matrix description when its poles pass to infinity. To illustrate both relations a simple model was considered. In this case the interaction in internal region s described by the square-well potential with repulsive core. The apparent analytical relations were obtained.

47600 **(JINR—R-2-84-646) Slope parameters of $\pi\pi$-system.** Isaev, P.S.; Osipov, A.A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1984. 4p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE85702092.

The slope parameters of the $\pi\pi$-system are calculated in the framework of the superconductor-tupe quark model. The analogous calculations are made for $\pi$K-system. The amplitudes are obtained by using the box quark diagrams and tree diagrams with the intermediate scalar epsilon(700), Ssup(x)(975), K tilde (1350) mesons and vector rho(770), $K^*$ (892) mesons.

47601 **(JINR—R-4-84-427) Modelless estimate of weight of 6q-admixture in deuteron on the basis of P-matrix analysis of $^3S_1$-phase of NN-scattering.** Efimov, V.N. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics). 1984. 6p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE85702093.

A determination of probability of six-quark component of NN-wave functions in the framework of the hybrid (quark-cluster) model of NN-states is considered. The method is based on the condition of orthogonality of wave functions without any assumption of six-quark cluster dynamics and deals with exterion NN-interactions and experimental phase shifts. The weights of six-quark configurations in deuteron for a number of exterior NN-potentials and for series of 6q-cluster radius are obtained.

47602 (KMU-HEP—84-08, pp 77-89) **Production of the vector mesons and photons in the $\gamma\gamma$ collisions at s >> p/sub transverse//sup 2/ >> $\mu^2$ and the problem of perturbative QCD Pomeron.** Ginzburg, I.F.; Panfil, S.L.; Serbo, V.G. (Novosibirskij Gosudarstvennyj Univ. (USSR)). Jun 1984. NTIS (US Sales Only), PC A06/MF A01. File Number DE85781587. (CONF-8403194—).

From 15. spring symposium on high energy physics; Georgenthal, German D.R. (26 Mar 1984).

Within the framework of low order perturbative QCD cross sections have been calculated for the exclusive reactions $\gamma\gamma \to V_1V_2$, $\gamma\gamma \to \gamma V$, $\gamma\gamma \to \gamma\gamma$ and the semiexclusive reactions $\gamma\gamma \to V+X$, $\gamma\gamma \to \gamma+X$ at s >> p/sub transverse//sup 2/ >> $\mu^2$. V stands for a neutral vector meson (rho$^0$, $\omega$, PHI, PSI) and X is a hadron system the effective mass of which is not large. The cross sections do not depend on s and vary from 3 x $10^{-34}$ $cm^2$ to $10^{-38}$ $cm^2$ at t = -3 $GeV^2$. The energy dependence of the semihard processes studied is determined by the Pomeranchuk singularity (perturbative Pomeron). For some experimental facilities (PETRA, SLC, VLEPP) the possibilities of investigating in detail the perturbative Pomeron in almost all the reactions considered are discussed.

47603 (KMU-HEP—84-08, pp 90-94) **Particle production in hadron-hadron collisions in a dual multi-string fragmentation model.** Ranft, J. (Karl-Marx-Universitaet, Leipzig (German Democratic Republic). Sektion Physik). Jun 1984. NTIS (US Sales Only), PC A06/MF A01. File Number DE85781587. (CONF-8403194—).

From 15. spring symposium on high energy physics; Georgenthal, German D.R. (26 Mar 1984).

The physical mechanism responsible for the violation of the Kola-Nolsen-Olesen (KNO) scaling behaviour within a dual multi-string fragmentation model is studied. Three different features concerning the multiplicity distributions are discussed and presented graphically. Agreement has been found between the non-KNO-scaling behaviour of experimental data and the model.

47604 (KMU-HEP—84-08, pp 95-99) **Study of average multiplicities, rapidity distributions and ratios and x-distributions in hadron-nucleus collisions in the dual multi-chain Monte-Carlo fragmentation model.** Ritter, S. (Karl-Marx-Universitaet, Leipzig (German Democratic Republic). Sektion Physik). Jun 1984. NTIS (US Sales Only), PC A06/MF A01. File Number DE85781587. (CONF-8403194—).

From 15. spring symposium on high energy physics; Georgenthal, German D.R. (26 Mar 1984).

Data measured in hadron-nucleus interactions are studied within the framework of the multi-chain Monte Carlo fragmentation model. Average multiplicities for all charged particles and negative charged particles measured in proton-xenon, antiproton-xenon, proton-argon, antiproton-argon as well as proton-antiproton and proton-proton collisions at 200 GeV/c are compared to Monte Carlo results. Furthermore, comparisons between experimental and Monte Carlo data are presented for rapidity distributions and ratios for projectile protons and different targets. Finally, the differential cross sections E$d\sigma/dp^3$ measured at fixed transverse momentum of 0.3 GeV/c and p/sub lab/ = 100 GeV/c are shown ranging between approximately 0.2 and 0.8. The Monte Carlo curves to be compared with are corrected by some factor due to the using of all transverse momenta in order to obtain the Monte Carlo results.

47605 (KMU-HEP—84-08, pp 6-12) **Gluonic interactions from lattice QCD.** Michael, C. (Liverpool Univ. (UK). Dept. of Applied Mathematics and Theoretical Physics). Jun 1984. NTIS (US Sales Only), PC A06/MF A01. File Number DE85781587. (CONF-8403194—).

From 15. spring symposium on high energy physics; Georgenthal, German D.R. (26 Mar 1984).

Gluonic interactions are studied within lattice QCD. Hybrid mesons in which the gluonic field is excited into a higher energy state are evidenced from studying the static source potential and discovering that there is a spectrum of such potentials V/sub i/(R) unlike the unique potential obtained in electrodynamics. Results of the string tension K, namely (V(R+a)-V(R))/a, have been reanalyzed and using variational methods excellent consistency was achieved and is presented as a plot of V(R) versus R. Potentials corresponding to excited states of the gluonic field are obtained as main new results.

47606 (KMU-HEP—84-08, pp 13-18) **Some aspects of very hot matter.** Kaellman, C.G. (Helsinki Univ. (Finland). Research Inst. for Theoretical Physics). Jun 1984. NTIS (US Sales Only), PC A06/MF A01. File Number DE85781587. (CONF-8403194—).

From 15. spring symposium on high energy physics; Georgenthal, German D.R. (26 Mar 1984).

The problem posed by the plasmon in hot gluon matter or QCD is discussed within perturbation theory. Some mean-field models have been suggested in order to circumvent the infrared problems of perturbation theory but these models turn out to have severe problems too. Large N thermodynamics and some effective models allowing solitons are finally discussed.

47607 (KMU-HEP—84-08, pp 19-21) **Hamiltonian Monte Carlo studies of 1 + 1 dimensional lattice gauge theories with fermions, gauge bosons and scalar fields.** Ranft, J. (Karl-Marx-Universitaet, Leipzig (German Democratic Republic). Sektion Physik). Jun 1984. NTIS (US Sales Only), PC A06/MF A01. File Number DE85781587. (CONF-8403194—).

From 15. spring symposium on high energy physics; Georgenthal, German D.R. (26 Mar 1984).

Solitons with fractional fermionic charge are studied. According to the lattice Hamiltonian used within an Abelian gauge-Higgs model, solitons with half-integral fermionic charge are found to become confined except for a liberation field angle theta = $\pi/2$, where they can exist as free collective excitations of both the original soliton and the fermionic degrees of freedom. For a global fermionic charge (g=0), fractionally charged solitons exist as free states. Hints are also found for a phase transition from free to confined charged solitons at theta = $\pi/2$, decreasing the Yukawa coupling at fixed gauge coupling g and Higgs potential parameter phi$_0$.

47608 (KMU-HEP—84-08, pp 28-46) **Extraction of higher dimensional gluon condensation parameters from SU(3) Monte Carlo lattice data.** Makhaldiani, N. (Joint Inst. for Nuclear Research, Dubna (USSR)); Mueller-Preussker, M. (Humboldt-Universitaet, Berlin (German Democratic Republic). Sektion Physik). Jun 1984. NTIS (US Sales Only), PC A06/MF A01. File Number DE85781587. (CONF-8403194—).

From 15. spring symposium on high energy physics; Georgenthal, German D.R. (26 Mar 1984).

First numerical estimates of the $<G^3>$ and $<G^4>$ matrix elements from Monte Carlo simulations in pure SU(3) Yang-Mills theory are presented. The SU(3) vacuum expectation values of lattice operators have been calculated using the Monte Carlo heatbath procedure on a $4^4$ lattice with periodic boundary conditions. Fitted data are given for renormalization invariant gluon condensation parameters as well as for renormalization non-invariant ones. Monte Carlo data <S/sup L/> and <Q/sub i//sup L/> (i = 1...6) and fitted curves are plotted versus $1/g_0^2$ (ranging from 0.9 to 1.6). Recently calculated anomalous dimensions and corresponding linear combinations of the D = 8 operators are taken into account in order to extract the non-perturbative vacuum condensate values for the renormalization invariant local operators. The large condensation parameter values found indicate both a violation of the factorization hypothesis $<G^4>$ proportional to $<G^2>^2$ and a slow convergence of the operator expansion in the charmonium quantum chromodynamical sum rules.

47609 (KMU-HEP—84-08, pp 62-65) **Approach to the calculation of nonperturbative energy level shifts in heavy quarkonia. A critical appraisal.** Olejnik, S. (Slovenska Akademia Vied, Bratislava (Czechoslovakia). Fyzikalny Ustav). Jun 1984. NTIS (US Sales Only), PC A06/MF A01. File Number DE85781587. (CONF-8403194—).

From 15. spring symposium on high energy physics; Georgenthal, German D.R. (26 Mar 1984).

In order to test a method of calculating heavy quarkonium level shifts due to vacuum fields an exactly solvable generalized oscillator model proposed by Zalewski has been studied. Results of the calculation of the ground-state energy in the Zalewski model are presented and compared for different approximations with the exact ground state energies. It is concluded that the calculation of properties of heavy quarkonia can be reliable only when supplied with improved knowledge of the QCD vacuum and excited states.

47610 (KMU-HEP—84-08, pp 100-107) **Experimental status of light pseudoscalar particles.** Bluemlein, J. (Akademie der Wissenschaften der DDR, Berlin-Zeuthen. Inst. fuer Hochenergiephysik). Jun 1984. NTIS (US Sales Only), PC A06/MF A01. File Number DE85781587. (CONF-8403194—).

From 15. spring symposium on high energy physics; Georgenthal, German D.R. (26 Mar 1984).

A brief review on the experimental status of light pseudoscalar particles is given and the status of different models involving axions is discussed.

47611 (LAL—84-45) **Study of direct photon photoproduction. Cross sections and characteristic events.** Wormser, G. (Paris-11 Univ., 91 - Orsay (France). Lab. de l'Accelerateur Lineaire; Paris-11 Univ., 91 - Orsay (France)). Dec 1984. 221p. (In French). NTIS (US Sales Only), PC A10/MF A01. File Number DE85752141.

The study of high transverse momentum scattering of energetic photons is a powerful way to get a deep understanding of matter structure. The measurement of elastic photon-quark scattering (QED Compton effect) provides a unique possibility of testing the fractional charge of the quarks. Quantum chromodynamics predicts other reactions leading to prompt $\gamma$ in the final state. We present the results obtained by the NA14 experiment carried out at the CERN SPS, using a photon beam of mean energy, 80 GeV. The inclusive transverse momentum and energy spectra are presented for both $\pi^0$ and prompt $\gamma$ candidates. A clear prompt $\gamma$ signal, for transverse momentum >2.5 GeV/c, is then seen, using an estimation of the contamination given by the analysis of $\pi^-$ beam data taken in our apparatus and a Monte-Carlo simulation. The observed cross-section is in good agreement with QCD prediction. We can rule out the gauge integer charge models proposed so far. The study of exclusive characteristics of events associated with a prompt $\gamma$ candidate enables us to measure in an independant way the fraction of QED Compton-like events in our data sample. The result is in good agreement with the theoretical prediction and shows that QED Compton is the dominant sources of prompt $\gamma$ at high transverse momentum.

47612 (LBL—18571, pp 8-12) **Intermediate mass Higgs.** Lane, K. (Ohio State Univ., Columbus). Oct 1984. NTIS, PC A05/MF A01. File Number DE85004444. (CONF-8406190—). Contract AC02-76ER01545.

From Theoretical workshop on electroweak symmetry breaking at the superconducting super collider; Berkeley, CA, USA (4 Jun 1984).

The subgroup concentrated on two problems. The first was how to search for a standard neutral Higgs, $H^0$, in the intermediate mass range, 2m/sub t/ < m/sub H/ < 2m/sub W/. The only method not obviously swamped by background is $H^0$ production in association with $W^{+-}$, with $H^0 \rightarrow t$ anti t and $W \rightarrow l$ nu. However, this strategy puts great demands on the ability to identify t-quarks efficiently. The second problem addressed was the detectability of $H^0$ in the mass range 200 to 400 GeV. The question of signal versus background for a fusion-produced $H^0$ was reexamined. Heavy $H^0$ production in association with a $Z^0$ was also studied. The fusion process, with $H^0$ decay to $W^+W^-$ or $Z^0Z^0$, remains by far the most promising way to look for a heavy Higgs scalar.

47613 (LPC—84-01) **Direct-photon pair production.** Carimalo, C.; Crozon, M.; Kessler, P.; Parisi, J. (College de France, 75 - Paris. Lab. de Physique Corpusculaire). Feb 1984. 50p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85752146.

From Revized version;

Direct-photon pair production in high-energy hadron collisions is considered. After discussing general aspects of such reactions and giving a brief historical survey of that subject, we present some calculations on the contributions from q anti-q and g g collisions (the latter via the quark box) to the $\gamma\gamma$ continuum, and on possible resonant contributions. Finally, an estimation of the indirect-photon background (mainly due to $\pi^0$ and eta decay, and to quark bremsstrahlung) is given for colliding-beam conditions at high energy; assuming both photons to be measured at 90° with equal and opposite momenta, and (within experimental limits) unaccompanied by any hadrons or additional photons, it is shown that this background can be sharply reduced.

47614 (LPNHE—84-04) **Photon-photon collisions.** Field, J.H. (Paris-6 Univ., 75 (France). Lab. de Physique Nucleaire et de Hautes Energies). 1984. 262p. NTIS (US Sales Only), PC A12/MF A01. File Number DE85752145.

The current status, both theoretical and experimental, of two photon collision physics is reviewed with special emphasis on recent experimental results from $e^+e^-$ storage rings. After a complete presentation of the helicity amplitude formalism for the gener-

al process $e^+e^- \rightarrow Xe^+e^-$, various approximations (transverse photon, Weisaecker Williams) are discussed. Beam polarisation effects and radiative corrections are also briefly considered. A number of specific processes, for which experimental results are now available, are then described. In each case existing theoretical prediction are confronted with experimental results. The processes described include single resonance production, lepton and hadron pair production, the structure functions of the photon, the production of high Psub(T) jets and the total photon photon cross section. In the last part of the review the current status of the subject is summarised and some comments are made on future prospects. These include both extrapolations of current research to higher energy machines (LEP, HERA) as well as a brief mention of both the technical realisation and the physics interest of the real $\gamma\gamma$ and e$\gamma$ collisions which may be possible using linear electron colliders in the 1 TeV energy range.

47615 **(PB—85-186476/XAB) Unavoidable errors in the determination of the kinematic variables x,$Q^2$ for charged current events at HERA.** Bowler, M.G.; Lloyd, S.L. (Oxford Univ. (UK). Nuclear Physics Lab.). 1983. 14p. NTIS, PC E03/MF E03.

It is shown that the kinematic variables x,$Q^2$, calculated from current jet momentum and energy, depart from the true values by an amount which depends on the mass of the target (spectator) jet. Essential information is therefore lost down the beam pipe, resulting in an unavoidable loss of resolution at HERA. The kinematic regions seriously affected are identified.

47616 **(PB—85-190635/XAB) Corrections to the adiabatic limit in the flux-tube model.** Merlin, J.; Paton, J. (Oxford Univ. (UK). Dept. of Theoretical Physics). 1984. 23p. NTIS, PC E03/MF E03.

Corrections to the adiabatic potential picture of q (q bar) systems are estimated using a flux-tube model recently described. Mixing of the lowest adiabatic surfaces is small for heavy quark systems. For light quark systems, the authors suggest a way of redefining the adiabatic surfaces so that in this case also mixing effects are small. Mixing effects are included in estimates of the lowest hybrid masses.

47617 **(SLAC-PUB—3703) Pion-Skyrmion scattering: collective coordinates at work.** Peskin, M.E. (Stanford Linear Accelerator Center, Menlo Park, CA (USA)). Jun 1985. Contract AC03-76SF00515. 22p. (CONF-8505192—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85014957.

From Symposium on the recent developments in quantum field theory; Copenhagen, Denmark (6 May 1985).

It is argued that the Skryme model, and more generally, the picture of the nucleon as a chiral soliton, can give a qualitatively correct picture of pion-nucleon scattering, considering both group-theoretic and more scheme-dependent results. The properties of the nucleon and its excited states in large-N quantum chromodynamics are discussed qualitatively. Then the pion-nucleon S-matrix is reduced. It is found that the model succeeds at the first level of calculation in producing many of the features of pion-nucleon scattering which are revealed by experiment, but that many aspects of the description need to be better understood, including the treatment of nonleading corrections near threshold and the inclusion of inelastic channels. 22 refs., 8 figs. (LEW)

47618 **(USIP—84-02) Study of the interpretations of charm particle decays into three charged particles in NA16.** Moa, T. (Stockholm Univ. (Sweden). Inst. of Physics). Mar 1984. 31p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85702084.

The variation of the kinematic fit probability as a function of the mass of the decaying particle is studied for all hypotheses tried for the three prong charged decays in the NA16 LECB-EHS experiment.

47619 **(USIP—84-09) Weak mixing angles and heavy flavours.** Jarlskog, C. (Stockholm Univ. (Sweden). Inst. of Physics). May 1984. 22p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85702094.

The present status of the weak mixing angles, in the standard six quark model, is reviewed. The implications of the recent measurements of the beauty lifetime and branching ratios are discussed, in the framework of the Kobayashi-Maskawa and the Wolfenstein parametrizations. Expectations for B(sup)o - B(sup)-o mixing and consequences for the collider data are given. Other topics briefly reviewed are CP-violation, top quark mass and possible implications of the existence of a fourth family.

47620 **Constraints on the Higgs-boson masses in left-right electroweak gauge theories.** Olness, F.I.; Ebel, M.E. (Department of Physics, University of WisconsinMadison, Madison, Wisconsin 53706). *Physical Review [Section] D: Particles and Fields;* **32**: No. 7, 1769-1779(1 Oct 1985). Contract AC02-76ER00881.

We consider the minimal left-right-symmetric electroweak model and characterize the range of allowable masses for the physical Higgs boson. We use two approaches: (1) We compute the lowest-order boson-boson scattering amplitude and impose a unitarity constraint on the J = 0 partial-wave amplitude; (2) we compute the radiative corrections to the Higgs-boson propagator and determine the range of Higgs-boson masses for which the perturbation series converges. Both methods give upper bounds on the Higgs-boson masses in terms of the gauge-boson masses, and we discuss the theoretical connection. The generalizations of these constraints and their applicability in light of previous bounds is examined.

47621 **Weak D→K$\pi$ decays revisited.** Kamal, A.N.; Scadron, M.D. (Stanford Linear Accelerator Center, Stanford University, Stanford, California 94305). *Physical Review [Section] D: Particles and Fields;* **32**: No. 5, 1164-1169(1 Sep 1985). Contract AC03-76SF00515;AC02-80ER10663.

Soft theorems of current algebra are consistently applied to D→K$\pi$ decay amplitudes from which D( F( and K( pole contributions have been removed. The K( pole, ignored in previous calculations, represents the contribution of the flavor annihilation channel. The net effect is an improved, though not entirely satisfactory, understanding of D→K$\pi$ data, with real amplitudes. Final-state interactions are introduced to give a fit to data.

47622 **New standard-model test for future colliders.** Duncan, M.J.; Kane, G.L.; Repko, W.W. (Randall Physics Laboratory, University of Michigan, Ann Arbor, Michigan 48109). *Physical Review Letters;* **55**: No. 8, 773-775(19 Aug 1985). Contract AC02-76ER01112.

We point out that for W-pair production from $e^+e^-$ or qq-bar beams, the correlation between the decay planes of the W's is numerically negligible (at tree level) in the standard model. This occurs for the production of WW via intermediate fermions or gauge bosons, and independently for WW produced via Higgs boson exchange and is not restricted to two-body diagrams. In general, the correlation need not vanish, so a nonzero correlation would be a clear signal of physics beyond the standard model. Definition of the W-decay plane should be fairly straightforward from the decay W→ff-bar and, hence, the correlation measurement is experimentally feasible.

47623 **Possibility of deeply-bound dibaryon resonances.** Maltman, K. (Lawrence Berkeley Lab., CA). *Nuclear Physics [Section] A;* **438**: No. 3/4, 669-684(27 May 1985).

The question of the existence of deeply-bound positive-parity non-strange dibaryon resonances is addressed in the context of a QCD-like potential model. Hyperfine effects are found to produce strong binding in certain non-NN channels, notably the I = 0, S = 3 channels which predicted to lie well below the N$\Delta\pi$ threshold.

47624 **Heavy families: masses and mixings.** Bagger, J.; Masso, E.; Dimopoulos, S. (Stanford Linear Accelerator Center, CA). *Nuclear Physics [Section] B;* **253**: No. 3/4, 397-420(13 May 1985).

We use the infrared fixed-point structure of the SU(3)xSU(2)xU(1) renormalization group equations to derive predictions for the masses and mixings of heavy families in perturbatively unifiable grand unified theories. We show that the sum of the squares of all quark (or lepton) masses must be less than (355

GeV)². This implies that theories with Nsub(H) heavy families must have at least one new quark and one new lepton of mass less than 250/√Nsub(H) GeV. We also find that the Cabibbo mixings and isospin splittings of heavy quarks tend to be small.

47625 **Monte Carlo studies of t quarks.** Protopopescu, S.D. (Brookhaven National Laboratory, Upton, N.Y. (USA)). pp 487-489 of Proceedings of physics in collision 3., and of the Workshop on search for heavy flavours. Bellini, G.; Bettini, A.; Perasso, L. (eds.). Gif-sur-Yvette, France; Editions Frontieres (1984). (CONF-8308145—).

From Workshop on search for heavy flavors; Como, Italy (29 Aug 1983).

Some results of a Monte Carlo study of top quarks with the Program ISAJET are described. Top quarks can be produced by QCD processes such as q anti q → t anti t or gg → tt or from the decay $W^{+-}$ → t anti b(anti tb). The cross section depends on the t mass and the center of mass energy. The ISAJET program includes scaling violations in jet fragmentation using the Altarelli-Parisi equations.

47626 **Properties of b-flavored hadrons.** Jaros, J.A. (Stanford Linear Accelerator Center, Stanford Univ., Stanford, CA (USA)). pp 267-277 of Proceedings of physics in collision 3., and of the Workshop on search for heavy flavours. Bellini, G.; Bettini, A.; Perasso, L. (eds.). Gif-sur-Yvette, France; Editions Frontieres (1984). (CONF-8308145—).

From Workshop on search for heavy flavors; Como, Italy (29 Aug 1983).

Experimental progress in the study of b-flavored hadrons is reviewed. The observation of the B meson, properties of hadronic B decays, semi-leptonic B decays, and the B lifetime are discussed.

## 6453 Particle Invariance Principles And Symmetries

*REFER ALSO TO CITATION(S) 47583, 47645, 47648*

## 6454 Field Theory

*REFER ALSO TO CITATION(S) 47553, 47590, 47591, 47620, 47624, 47625*

47627 **(BONN-HE—85-08) Monte Carlo study of the four-dimensional anisotropic U(1) gauge theory (lattice dimensional reduction).** Gupta, N.; Katznelson, E. (Bonn Univ. (Germany, F.R.). Physikalisches Inst.). Mar 1985. 14p. B. File Number DE85752237.

We study the four-dimensional U(1) gauge theory with anisotropic couplings ($\beta_1$, for the XY, XZ, XT plaquettes and $\beta_2$ for the YZ, YT, ZT plaquettes) by Monte Carlo simulation. We obtain the phase diagram and find that the effects of anisotropy are not washed out by the phase transition. Our phase diagram confirms the phase diagram obtained by mean-field theory with one loop corrections.

47628 **(DESY—85-028) Existence of the real time evolution in euclidean lattice gauge theories.** Fredenhagen, K. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Apr 1985. 13p. B. File Number DE85752239.

A simple argument is given which excludes the occurence of zero eigenvalues of the transfer matrix in euclidean lattice gauge theories.

47629 **(DESY—85-035) Computation of the action for on-shell improved lattice gauge theories at weak coupling.** Luescher, M.; Weisz, P. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (Germany, F.R.)). Apr 1985. 18p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85752324.

The coefficients in Symanzik's improved lattice action for (pure) SU(2) and SU(3) gauge theories are determined to one-loop order by requiring the absence of leading scaling violations in a set of on-shell quantities, which arise in a world where 2 dimensions are compactified in a twisted manner.

47630 **(INIS-mf—9351, pp 385-391) Covariant momentum projection of the soliton bag. Recoil corrections to the hadronic masses.** Wilets, L.; Birse, M.C.; Luebeck, G.; Henley, E.M. (Washington Univ., Seattle). 1984. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781594. (CONF-8409143—).

From 7. international conference on atomic masses and fundamental constants (AMCO-7); Darmstadt-Seeheim, F.R. Germany (3 Sep 1984).

The soliton model, for the present discussion, contains (massless) quarks interacting with a nonlinear scalar field sigma; the momentum operator conjugate to sigma is $\pi$ = sigma, and the two satisfy the usual canonical equal-time commutation relations. (orig./HSI).

47631 **(INS—489) Microcanonical formulation of quantum field theories.** Iwazaki, A. (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). Mar 1984. 14p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85702046.

A microcanonical formulation of Euclidean quantum field theories is presented. In the formulation, correlation functions are given by a microcanonical ensemble average of fields. Furthermore, the perturbative equivalence of the formulation and the standard functional formulation is proved and the equipartition low is derived in our formulation.

47632 **(JINR—E-2-84-410) Analytical methods for multiloop calculations (Two lectures on the method of uniqueness).** Kazakov, D.I. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1984. 24p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85702047.

In the present lectures we give a step-by-step description of the analytical methods for multiloop calculations.

47633 **(JINR—E-2-84-465) Yang-Feldman equation in conformally invariant QED.** Stoyanov, D.T. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1984. 7p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85702051.

A recently proposed new gauge condition for electromagnetic potential in QED is discussed. This condition allows one to extend the Hilbert state-space in such a way that the physical subspace is conformal-invariant and Maxwell equations in it are automatically fulfilled. This state-space structure gives a possibility of constructing the Yang-Feldman type integral equation, which leads to a new formulation of quantum electrodynamics.

47634 **(JINR—R-2-84-302) Monte Carlo calculation methods in modern problems of lattice field theory.** Makhaldiani, N.V.; Mueller-Preussker, M.; Shmakov, S.Yu. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation). 1984. 16p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE85702048.

The methods of calculations in the framework of the lattice quantum field theory with Monte Carlo procedure of simulation of the gauge field configurations and stochastic inversion of large sparse matrix is revised. The application of the methods is illustrated in the calculation of the fermion condensate matrix elements.

47635 **(JINR—R-2-84-530) Operator identities in the problem about zero mode cancellation.** Zlatev, S.I.; Matveev, V.A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1984. 12p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE85702049.

Using the one-dimensional quantum mechanical model as an example the method of operator identities is developed which allows one to formalize a proof of an exact cancellation of zero mode contributions at any order of a proper quasiclassical loop expansion. The performed analysis leads naturally to the necessity of introduction of new vertices and diagrams corresponding to a modified perturbation theory.

47636 (KMU-HEP—84-08, pp 22-27) **Hamiltonian Monte Carlo study of the N=1 Wess-Zumino model on the lattice in 1 + 1 dimensions.** Schiller, A. (Karl-Marx-Universitaet, Leipzig (German Democratic Republic). Sektion Physik). Jun 1984. NTIS (US Sales Only), PC A06/MF A01. File Number DE85781587. (CONF-8403194—).

From 15. spring symposium on high energy physics; Georgenthal, German D.R. (26 Mar 1984).

1 + 1 dimensional models with restricted supersymmetry are studied. The problems of formulating supersymmetric models on the lattice are overcome by working in the Hamiltonian lattice formulation and using restricted supersymmetry algebra involving only the Hamiltonian. For the two-dimensional Wess-Zumino model a lattice Hamiltonian suitable for the local Hamiltonian method is obtained. Using this method field theoretical models with fermions and scalar Higgs fields are investigated. Emphasis is laid on supersymmetry breaking and soliton formation.

47637 (KMU-HEP—84-08, pp 47-50) **Improved mean-field calculation for the lattice Abelian Higgs model.** Pertermann, D. (Karl-Marx-Universitaet, Leipzig (German Democratic Republic). Sektion Physik). Jun 1984. NTIS (US Sales Only), PC A06/MF A01. File Number DE85781587. (CONF-8403194—).

From 15. spring symposium on high energy physics; Georgenthal, German D.R. (26 Mar 1984).

The phase structure is studied of the lattice Abelian Higgs model with frozen radial degrees of freedom for Higgs charges q = 1, 2, and 6 and dimension d = 4. The results are based on simple mean-field calculations corrected by considering small quantum fluctuations of the fields around their mean values. Analytical approximations are presented for the phase transition lines between the Confinement, Higgs and Coulomb phases. A comparison is made for Monte Carlo, simple mean-field and improved mean-field calculations.

47638 (KMU-HEP—84-08, pp 51-61) **Scalar free field transformation of the Liouville field theory.** Otto, H.J. (Humboldt-Universitaet, Berlin (German Democratic Republic). Sektion Physik); Weigt, G. (Akademie der Wissenschaften der DDR, Berlin-Zeuthen. Inst. fuer Hochenergiephysik). Jun 1984. NTIS (US Sales Only), PC A06/MF A01. File Number DE85781587. (CONF-8403194—).

From 15. spring symposium on high energy physics; Georgenthal, German D.R. (26 Mar 1984).

It is tried to overcome the restriction to unphysically high critical space-time dimensions in quantizing strings. For space-time dimensions d < 26 the quantized Liouville field has been included into the string model considerations. The quantization of the Liouville field in a Fock space restricted to nonsingular periodic Liouville fields related to closed strings is presented.

47639 (LBL—19746) **Confinement at large-N.** Klinkhamer, F.R. (Lawrence Berkeley Lab., CA (USA)). Jun 1985. Contract AC03-76SF00098. 23p. (CONF-8505188—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85016645.

From Conference on quark confinement and liberation: numerical results and theory; Berkeley, CA, USA (22 May 1985).

Recent numerical results indicate that QCD in the limit of an infinite number (N) of colors also has confinement and moreover that it looks rather similar to normal QCD with N = 3 colors. This imposes severe restrictions on what the mechanism of confinement can be.

47640 (NIKHEF-H—84-11) **Lattice theory for nonspecialists.** Hari Dass, N.D. (Nationaal Inst. voor Kernfysica en Hoge-Energiefysica (NIKHEF), Amsterdam (Netherlands). Sectie H). Sep-Oct 1984. 55p. NTIS (US Sales Only), PC A04/MF A01. File Number DE85702050.

These lectures were delivered as part of the academic training programme at the NIKHEF-H. These lectures were intended primarily for experimentalists, and theorists not specializing in lattice methods. The goal was to present the essential spirit behind the lattice approach and consequently the author has concentrated mostly on issues of principle rather than on presenting a large amount of detail. In particular, the author emphasizes the deep theoretical infra-structure that has made lattice studies meaningful. At the same time, he has avoided the use of heavy formalisms as they tend to obscure the basic issues for people trying to approach this subject for the first time. The essential ideas are illustrated with elementary soluble examples not involving complicated mathematics. The following subjects are discussed: three ways of solving the harmonic oscillator problem; latticization; gauge fields on a lattice; QCD observables; how to solve lattice theories.

47641 **Fast algorithm for Monte Carlo simulations of systems with fermions.** Grady, M. (High Energy Physics Division, Argonne National Laboratory, Argonne, Illinois 60439). *Physical Review [Section] D: Particles and Fields;* **32**: No. 6, 1496-1502(15 Sep 1985). Contract W-31-109-ENG-38.

A fast algorithm for computing the effects of the fermionic determinant in a lattice field theory is presented which involves only local field updates. The method makes use of bosonic pseudofermion fields, but differs from other pseudofermion techniques in that it has no built-in systematic error. In particular, the magnitude of changes in the gauge field from one configuration to the next need not be restricted. The method is successfully demonstrated in a two-dimensional U(1) lattice gauge theory coupled to spinless fermions.

47642 **Boson subalgebras and classification of boson state vectors.** Bolsterli, M. (T Division, Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Physical Review [Section] D: Particles and Fields;* **32**: No. 6, 1520-1529(15 Sep 1985).

In the construction and classification of the possible state vectors of a limited number of boson modes, the use of subalgebras of invariant operators can simplify the procedure. The subalgebra of all the invariant operators (invariant subalgebra) and the subalgebra generated by the invariant-pair operators (invariant-pair subalgebra) are both considered. The invariant-pair subalgebra has the decisive advantage of allowing the easy evaluation of matrix elements. The construction problem is reduced to the problem of constructing the invariant-pair-free states, and a general procedure for determining these states is presented.

47643 **Evolution equation and relativistic bound-state wave functions for scalar-field models in four and six dimensions.** Brodsky, S.J.; Ji, C.; Sawicki, M. (Stanford Linear Accelerator Center, Stanford University, Stanford, California 94305). *Physical Review [Section] D: Particles and Fields;* **32**: No. 6, 1530-1538(15 Sep 1985). Contract AC03-76SF00515.

We investigate the evolution equation for distribution amplitudes in the framework of a scalar theory quantized on the light cone. We find general solutions for the cases of 4 and 6 dimensions and use them to reconstruct two-body relativistic bound-state wave functions at small distances. The relation between the light-cone bound-state equation and the Bethe-Salpeter equation is discussed.

47644 **Spin-dependent forces in heavy-quark systems.** Ng, Y.J.; Pantaleone, J.; Tye, S.H. (Institute of Field Physics, Department of Physics and Astronomy, University of North Carolina, Chapel Hill, North Carolina 27514). *Physical Review Letters;* **55**: No. 9, 916-919(26 Aug 1985).

The spin-dependent potentials in the formalism of Eichten and Feinberg and of Gromes are generalized. Consistency of the observed spin splittings in the J/psi and Y systems with QCD imposes stringent constraints on the type of nonperturbative spin-dependent forces allowed.

47645 **Renormalization-group constraints in supersymmetric theories.** Bagger, J.; Dimopoulos, S.; Masso, E. (Lyman Laboratory of Physics, Harvard University, Cambridge, Massachusetts 02138). *Physical Review Letters;* **55**: No. 9, 920-922(26 Aug 1985). Contract AC03-76SF00515.

We use the SU(3)xSU(2)xU(1) renormalization-group equations to constrain fermion masses and charged-scalar couplings in supersymmetric grand unified theories.

**47646** **Quantum holonomy and the chiral gauge anomaly.** Niemi, A.J.; Semenoff, G.W. (Institute for Advanced Study, Princeton, New Jersey 08540). *Physical Review Letters;* **55**: No. 9, 927-930(26 Aug 1985). Contract AC02-76ER02220.

The chiral gauge anomaly is studied by use of the U(1) holonomy on the space of all gauge fields. On this space an Abelian gauge structure is identified and the anomaly is related to the pertinent field-strength tensor and computed by use of the eta invariant of five-dimensional Dirac operator.

**47647** **Quaternionic quantum field theory.** Adler, S.L. (The Institute for Advanced Study, Princeton, New Jersey 08540). *Physical Review Letters;* **55**: No. 8, 783-786(19 Aug 1985). Contract AC02-76ER02220.

We show that a quaternionic quantum field theory can be formulated when the numbers of bosonic and fermionic degrees of freedom are equal and the fermions, as well as the bosons, obey a second-order wave equation. The theory is initially defined in terms of a quaternion-imaginary Lagrangian using the Feynman sum over histories. A Schroedinger equation can be derived from the functional integral, which identifies the quaternion-imaginary quantum Hamiltonian. Conversely, the transformation theory based on this Hamiltonian can be used to rederive the functional-integral formulation.

**47648** **Top-quark mass in grand-unified theories with intermediate scales.** Panagiotakopoulos, C.; Shafi, Q.; Wetterich, C. (The Rockefeller University, New York, New York 10021). *Physical Review Letters;* **55**: No. 8, 787-790(19 Aug 1985). Contract FG02-84ER40176.

The relation m/sub t//m/sub d/roughly-equalm/sub b//m/sub s/, which predicts a top-quark mass close to 40 GeV, is derived in the context of SO(10) and (and $E_6$) grand-unified theories with suitable intermediate scales.

**47649** **Energy crisis in anti-de Sitter supersymmetry.** Bardeen, W.A.; Freedman, D.Z. (Fermi National Accelerator Lab., Batavia, IL). *Nuclear Physics [Section] B;* **253**: No. 3/4, 635-649(13 May 1985).

The energy operator in AdS supersymmetry is formally positive, i.e. H proportional Σsub(α)[Qsub(α), Qsub(α)$^+$], but in supersymmetric field theories the standard energy density is not necessarily positive. Further, calculations of <H> by xi-function regularization of the sum of boson and fermion mode energies in a supermultiplet gives non-zero results. In two-dimensional interacting field theories with AdS supersymmetry, we calculate the energy operator and the other O(2,1) generators from the supercharge anticommutator [Qsub(α),anti Qsub($\beta$)] by canonical methods, and we find generators which differ from the standard ones by surface terms. The improved energy density is non-negative and vanishes only in supersymmetric configurations. We prove that radiative corrections to the improved <H> vanish to all orders in perturbation theory in supersymmetric vacua.

**47650** **Nuclear chromodynamics: applications of QCD to relativistic multiquark systems.** Brodsky, S.J.; Ji, C.R. (Stanford Linear Accelerator Center, CA (USA)). *Progress in Particle and Nuclear Physics;* **13**: 299-327(1985). (CONF-840435—). Contract AC03-76SF00515.

From International school of nuclear physics - nuclear and subnuclear degrees of freedom and lepton nucleus scattering course; Erice, Trapani, Italy (8 Apr 1984).

The authors review the applications of quantum chromodynamics to nuclear multiquark systems. In particular, predictions are given for the deuteron reduced form factor in the high momentum transfer region, hidden color components in nuclear wavefunctions, and the short distance effective force between nucleons. A new antisymmetrization technique is presented which allows a basis for relativistic multiquark wavefunctions and solutions to their evolution to short distances. Areas in which conventional nuclear theory conflicts with QCD are also briefly reviewed.

# 65 PHYSICS II

*REFER ALSO TO CITATION(S) 47469*

## 6510 Nuclear Physics

*REFER ALSO TO CITATION(S) 46240, 47792, 47980, 47989*

**47651** (GSI—85-10, pp 141-154) **Nuclear and atom physics experiments with cooled heavy ion beams of up to 500 MeV/u energy.** Kienle, P. Mar 1985. B. File Number DE85752251. (CONF-8410210—).

From 7. high energy heavy ion study conference; Darmstadt, F.R. Germany (8 Oct 1984).

I sketch a research program which we envisage for the time being to be carried out at the ESR storage and cooler ring for heavy ions, planned to be constructed at GSI Darmstadt.

**47652** (GSI—85-10, pp 155-167) **Pion production in heavy ion collisions close to absolute thresholds.** Stachel, J. Mar 1985. B. File Number DE85752251. (CONF-8410210—).

From 7. high energy heavy ion study conference; Darmstadt, F.R. Germany (8 Oct 1984).

Experiments performed at a beam energy of 35 MeV/u are discussed in some detail. The information from these experiments together with the results obtained at higher beam energies of 44 MeV/u, 48 MeV/u and 60-84 MeV/u is then discussed in order to distinguish between the alternative production mechanisms.

**47653** (GSI—85-10, pp 169-180) **Possible particle production experiments at SIS energies.** Grosse, E. Mar 1985. B. File Number DE85752251. (CONF-8410210—).

From 7. high energy heavy ion study conference; Darmstadt, F.R. Germany (8 Oct 1984).

It was the aim of this compilation of possible particle production experiments at SIS energies to show the potential progress which arises from large improvements in beam intensity and quality.

**47654** (GSI—85-10, pp 187-196) **Use of exotic nuclear beams for nuclear structure studies.** Sugimoto, K. Mar 1985. B. File Number DE85752251. (CONF-8410210—).

From 7. high energy heavy ion study conference; Darmstadt, F.R. Germany (8 Oct 1984).

Possible experiments are discussed for nuclear structure studies using, as secondary beams, projectile fragments produced by high-energy heavy-ion collisions. They are, specifically, a) determination of nuclear sizes from measurements of the total interaction cross sections of nucleus-nucleus collisions, and b) determination of static electromagnetic moments, $\mu$'s and Q's, or short-lived $\beta$-radioactive nuclei.

**47655** (INIS-mf—9351) **Atomic masses and fundamental constants. Proceedings.** Klepper, O. (ed.). (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)). 1984. 757p. (CONF-8409143—). NTIS (US Sales Only), PC A99/MF A01. File Number DE85781594.

From 7. international conference on atomic masses and fundamental constants (AMCO-7); Darmstadt-Seeheim, F.R. Germany (3 Sep 1984).

The proceedings contain the articles presented at the named conference. These concern the determination of nuclear masses by Q values in nuclear reactions, the determination of nuclear electric and magnetic moments, the theory of nuclear masses, the determination of weak interaction constants, and some experimental developments concerning such problems. Separate abstracts were prepared for the articles in the proceedings. (HSI).

**47656** (INIS-mf—9351, pp 29-35) **1983 atomic mass table and beyond.** Wapstra, A.H. (Nationaal Inst. voor Kernfysica en Hoge-Energiefysica (NIKHEF), Amsterdam, Netherlands). 1984. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781594. (CONF-8409143—).

From 7. international conference on atomic masses and fundamental constants (AMCO-7); Darmstadt-Seeheim, F.R. Germany (3 Sep 1984).

In the last days of 1983, Dr. G. Audi and I made the final calculations of tables of best values for atomic masses and related quantities, intended to replace the 1977 tables. These tables will be published in Nuclear Physics A (1984) in four parts: I. Atomic masses M in mass units; mass excesses M-A, total binding energies and beta decay energies in keV, with a short introduction and a graphical representation of the input data. II. Decay energies for $\alpha$, $2\beta$, $4\beta$, electron capture delayed proton and $\beta^-$ delayed neutron decay emission, separation energies for one and two protons and neutrons, (p,$\alpha$) and (n,$\alpha$) reaction energies and directions how to derive easily 28 other types of reaction energies from these data. III. Graphs (systematics) of Qsub($\alpha$), Q sub($\beta^-$), Q sub($2\beta^-$), Ssub(2p) and Ssub(2n) (with Dr. K. Bos). IV. Tables of input data, references to them and a description of details of the calculation (with ir. R. Hoekstra). (orig.).

47657 (INIS-SU—301, pp 3-17) **Discovery of the neutron (to the fiftieth anniversary of neutron discovery).** Pasechnik, M.V. 1984. (In Russian). NTIS (US Sales Only), PC A18/MF A01. File Number DE85781590. (CONF-8310228—Vol.1).

From 6. Soviet national conference on neutron physics; Kiev, USSR (10 Oct 1983).

Development of neutron physics in the USSR for the recent 50 years from the moment of neutron discovery is considered. History of neutron discovery is presented in brief. Neutron properties and fundamental problems of physics: electric dipole neutron moment, neutron $\beta$-decay, neutron interaction with nuclei and potential of nucleon interaction not conserving spatial parity are discussed. Main aspects of neutron physics application in power engineering, nuclear technology and other branches of science and technique are set forth. 26 references.

47658 (INIS-SU—301, pp 85-88) **Stable evaluation methods of neutron-physical characteristics of nuclides on the basis of experimental data.** Volkov, N.G.; Kryanev, A.V. (Moskovskij Inzhenerno-Fizicheskij Inst., USSR). 1984. (In Russian). NTIS (US Sales Only), PC A18/MF A01. File Number DE85781590. (CONF-8310228—Vol.1).

From 6. Soviet national conference on neutron physics; Kiev, USSR (10 Oct 1983).

Technique for obtaining estimations of neutron-physical characteristics of nuclides on the basis of stable estimation methods is set forth. The technique presupposes correction of incorrectly determined errors of measurements and disclosure of systematic errors with their succeeding accountancy. A system of orthogonal polynomials is used as approximating functional dependence. The technique is also generalized at the presence of correlation between measurements. 6 references.

47659 (KIYI—83-15, pp 20-24) **Potentialities of the directed neutron spectrum forming on the accelerated particle beams of U-240 cyclotron.** Isaev, A.G.; Kolotyj, V.V.; Kisurin, K.K.; Kushnir, I.I.; Labunskaya, S.F.; Maksimov, Yu.K.; Popov, V.V.; Khaldin, S.F. 1983. (In Russian). NTIS (US Sales Only), PC A03/MF A01. File Number DE85780968.

In Modernization of the U-240 isochronous cyclotron in 1982.

Experimental data on the directed neutron spectrum formation are obtained and its potentialities are investigated. The experimental results have shown the neutron spectrum maximum position to vary with the angle at which the spectrum is measured with the type of particles and also to depend on the energy of accelerated particles.

47660 (LUNFD6/NFFR—3052/1-250(1984)) **Catalogue of gamma rays from radionuclides ordered by nuclide.** Ekstroem, L.P.; Andersson, P.; Sheppard, H.M. (Lund Univ. (Sweden). Dept. of Physics). Jan 1984. 257p. NTIS (US Sales Only), PC A12/MF A01. File Number DE85702100.

A catalogue of about 28500 gamma-ray energies from 2338 radionuclides is presented. The nuclides are listed in order of increasing (A,Z) of the daughter nuclide. In addition the gamma-ray intensity per 100 decays of the parent (if known) and the decay half-life are given. All data are from a computer processing of a recent ENSDF (Evaluated Nuclear Structure Data File) file.

## 6511 Experimental Techniques

*REFER ALSO TO CITATION(S) 47056, 47118*

47661 (INIS-mf—9351, pp 307-313) **Present status and future prospects of on-line nuclear orientation.** Stone, N.J. (Oxford Univ. (UK). Clarendon Lab.). 1984. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781594. (CONF-8409143—).

From 7. international conference on atomic masses and fundamental constants (AMCO-7); Darmstadt-Seeheim, F.R. Germany (3 Sep 1984).

Three On-Line Nuclear Orientation (OLNO) facilities are now in operation. The first, the FOLBIS installation in Bonn, comprising a $^3$He/$^4$He dilution refrigerator connected directly to an isotope separator, has been working since 1977. Activities with lifetimes down to proportional 1h are brought to the separator and implanted into a polarised ferromagnetic foil attached to the mixing chamber of the refrigerator at proportional 100 mK. After a sufficiently strong source is produced the implantation is stopped and the source cooled to proportional 10 mK in proportional 0.5h for orientation measurement. This cycle is then repeated. The other two facilities, KOOL at Leuven and the refrigerator at the SERC Laboratory, Daresbury, U.K. are on-line both to the separator and to the source of isotopes. At Leuven this is a cyclotron and at Daresbury a heavy ion tandem. In both these facilities activities produced directly at a target which forms part of the separator ion source can be implanted into a cooled ferromagnetic foil held at proportional 15 mK. Depending upon the isotope half life these systems may either be used for cyclic implantation followed by orientation, or for continuous on-line operation. These facilities allow application of the nuclear orientation technique to a far wider range of isotopes extending frequently 8-10 mass units from stability. The method involves singles counting and experiments can be carried out on as few as $10^8$ nuclei of the desired isotope. (orig./HSI).

47662 (INIS-SU—301, pp 111-115) **Determination of errors of resonance curves at approximation by rational functions.** Badikov, S.A.; Gaj, E.V.; Rabotnov, N.S. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Obninsk. Fiziko-Ehnergeticheskij Inst.). 1984. (In Russian). NTIS (US Sales Only), PC A18/MF A01. File Number DE85781590. (CONF-8310228—).

From 6. Soviet national conference on neutron physics; Kiev, USSR (10 Oct 1983).

A method is proposed to determine the approximant's error for the rational function fit of the experimental curves (Pade-approximation). The method is based on the parameterisation by "supporting ordinates" and results in the diagonal covariance matrix of these parameters and in explicit expression for the error if measured values are statistically independent. The results of processing for the case of evaluation of the $^{238}$U(n,2n) reaction cross section in the energy range from the threshold to 19 MeV are presented.

## 6512 Nuclear Properties And Reactions, A=1-5, Theoretical

47663 (BONN-HE—85-10) **Calculation of proton-deuteron phase parameters including the Coulomb force.** Alt, E.O.; Sandhas, W.; Ziegelmann, H. (Bonn Univ. (Germany, F.R.). Physikalisches Inst.). Apr 1985. 66p. B. File Number DE85752238.

A previously proposed exact method for including the Coulomb force in three-body collisions is applied to proton-deuteron scattering. We present phase shifts for angular momenta up to L=9, from elastic threshold to 50 MeV proton laboratory energy. Separable rank-one potentials are taken for the nuclear interactions. A charge-independent and a charge-symmetric choise, while leading to different neutron-deuteron and proton-deuteron phase parameters, nevertheless yields practically the same Coulomb corrections.

We, moreover, investigate the question of P-wave resonances.A critical comparison of our results with those obtained in a co-ordinate space formalism is performed. Furthermore, proposals for an approximate inclusion of the Coulomb potential are tested, and found unsatisfactory.

47664 **(CERN-EP—85-79) Low energy antiproton annihilation on nuclei.** Piragino, G.; Balestra, F.; Batusov, Y.A.; Bendiscioli, G.; Bossolasco, S.; Bunyatov, S.A.; Bussa, M.P.; Busso, L.; Falomkin, I.V.; Ferrero, L. (Istituto Nazionale di Fisica Nucleare, Turin (Italy); Istituto Nazionale di Fisica Nucleare, Pavia (Italy); Istituto Nazionale di Fisica Nucleare, Frascati (Italy). Lab. Nazionale di Frascati; Joint Inst. for Nuclear Research, Dubna (USSR); Istituto Nazionale di Fisica Nucleare, Padua (Italy)). 21 May 1985. 9p. (CONF-850315—10). NTIS (US Sales Only), PC A02/MF A01. File Number DE85902044.

From Conference on antinucleon and nucleon-nucleus interactions; Telluride, CO, USA (18 Mar 1985).

Data obtained in the study of the antiproton interaction on $^4$He,Ne and photographic emulsion nuclei are reported. Charged prong multiplicities, branching ratios and reaction cross section values are given. Some features of anti p annihilation deep inside the nuclear matter are described. 17 refs., 8 figs.

47665 **(INIS-mf—9347) Calculation of the neutron-deuteron breakup cross section under inclusion of a three-nucleon potential.** Meier, W. (Bochum Univ. (Germany, F.R.). Abt. fuer Physik und Astronomie). 20 Jul 1983. 192p. (In German). NTIS (US Sales Only), PC A09/MF A01. File Number DE85781596.

Diss. (Dr.rer.nat.).

In this thesis the n-d breakup cross sections with unpolarized particles are determined in order to study the effect of the three-nucleon potential in this process. For this purpose the Faddeev equations for the transition operators and the resulting integral equations for the transition amplitudes are generalized in such a way that a three-nucleon potential can be included. (HSI).

47666 (INIS-SU—282, pp 214) **Calculation of the deuteron mean-square charge radius.** Kostin, R.L.; Trubnikov, S.V. 1984. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE85780893. (CONF-8404189—Summ.).

From 34. conference on nuclear spectroscopy and nuclear structure; Alma-Ata, USSR (17 Apr 1984).

47667 **(PITHA—83/24) Nuclear effects in deep inelastic lepton nucleon scattering at different momentum transfers.** Faissner, H.; Kim, B.R.; Reithler, H. (Technische Hochschule Aachen (Germany, F.R.). Lehrstuhl fuer Experimentalphysik 3B und 3. Physikalisches Inst.). Dec 1983. 18p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85752317.

The ratio of the structure function $F_2$sup(A)(x) of a nucleus A to that of deuterium $F_2$sup(D)(x) is computed for A = Fe, Al; $^{12}$C and $^4$He. The difference between lepton-nucleus and lepton-nucleon scattering is explained by a fraction g of the valence quarks of nuclear matter moving effectively in bags of doubled size (i.e. α's). The difference between EMC and SLAC data stems from the different effective quark mass, which is close to zero at $-q^2 = 100$ GeV$^2$, but (140 +- 25) MeV, at $\langle -q^2 \rangle = 3$ GeV$^2$. A cluster probability of g = 15% (10%) fits the Fe (Al) data well; g = 1/3 is predicted for $^4$He (and $^{12}$C) on grounds of the Barshay three gluon force.

47668 **Reaction $^2$H($^3$He,γ) $^5$Li at center-of-mass energies between 25 and 60 keV.** Cecil, F.E.; Cole, D.M.; Philbin, R.; Jarmie, N.; Brown, R.E. (Department of Physics, Colorado School of Mines, Golden, Colorado 80401). *Physical Review [Section] C: Nuclear Physics;* **32**: No. 3, 690-693(Sep 1985).

The gamma ray to proton branching ratio, Γ/sub γ//Γ/sub p/, of the $^2$H+ $^3$He reaction has been measured between center-of-mass energies of 25 and 60 keV. The ratio of the ground-state gamma reaction $^3$H($^3$He,γ$_0$) $^5$Li to the dominant reaction $^2$H($^3$He,p)$^4$He is observed to be roughly constant over this energy range with a best value of (4.5 +- 1.2) x $10^{-5}$. This ratio for the gamma-ray reaction to the $^5$Li first excited state is measured to have a value of (8 +- 3) x $10^{-6}$. The excitation energy of the first excited state is estimated to be 3.0 +- 1.0 MeV.

## 6513 Nuclear Properties And Reactions, A=6-19, Theoretical

*REFER ALSO TO CITATION(S) 47667, 47798, 47805*

47669 **(CEA-CONF—7572) Optical model and coupled channel analysis of anti p elastic and inelastic scattering.** Garreta, D.; Birien, P.; Bruge, G. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Aug 1984. 2p. (CONF-840789—14). NTIS (US Sales Only), PC A02/MF A01. File Number DE85752161.

From International conference on particles and nuclei; Heidelberg, F.R. Germany (30 Jul 1984).

Published in summary form only.

47670 **(CERN-EP—85-69) Search for antiproton-nucleus states.** Garreta, D.; Birien, P.; Bruge, G.; Chaumeaux, A.; Drake, D.M.; Janouin, S.; Legrand, D.; Lemaire, M.C.; Mayer, B.; Pain, J. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Physique Nucleaire; CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France); Strasbourg-1 Univ., 67 (France). Centre de Recherches Nucleaires; Tel Aviv Univ. (Israel)). 8 May 1985. 5p. (CONF-850152—11). NTIS (US Sales Only), PC A02/MF A01. File Number DE85901951.

From 3. LEAR workshop; Tignes-Savoie, France (19 Jan 1985).

The status of the present experimental search for resonant or bound quasi-nuclear anti p-states, using the knock-out reaction A(anti p,p)X at p/sub anti p/ = 600 MeV/c is presented. No evidence for such states could be found. Upper limits for the production of such states in $^6$Li and in $^{12}$C are one order of magnitude lower than theoretically predicted. These observations are consistent with the properties of the anti p-nucleus interaction as established from recent elastic and inelastic scattering as well as anti p-atom studies at LEAR. 13 refs., 2 figs.

47671 (GSI—85-10, pp 413-428) **Experiments using beams of unstable nuclear isotopes.** Tanihata, I. Mar 1985. B. File Number DE85752251. (CONF-8410210—).

From 7. high energy heavy ion study conference; Darmstadt, F.R. Germany (8 Oct 1984).

Secondary beams of $^3$He, $^4$He, $^6$He and $^8$He were produced through the projectile fragmentation of 800 MeV/nucleon $^{11}$B primary. Interaction cross sections (sigmasub(I)) of all He isotopes on Be, C, and Al targets were measured by a transmission-type experiment. The interaction nuclear radii of He isotopes have been deduced from the present sigmasub(I) and the known sigmasub(I) of $^4$He + $^4$He reactions.

47672 (GSI—85-10, pp 551-557) **Study of 1.7 AGeV $^{56}$Fe projectile fragment mean free paths in CR-39 track detectors.** Tincknell, M.L. Mar 1985. B. File Number DE85752251. (CONF-8410210—).

From 7. high energy heavy ion study conference; Darmstadt, F.R. Germany (8 Oct 1984).

This paper briefly summarizes results from two separate lines of work. The first, a methodological study, examined the merits and pitfalls of several statistical estimators of local mean free paths (mfp's). The usual estimator and standard error were found to be correct and not significantly biased in practice by a thorough analytic analysis. The seond part of this report discusses an experiment studying charge-changing interactions of fragments of $^{56}$Fe with $10 <= Z <= 24$ in Cr-39 etched nuclear track detectors. The present results contain a weak and oddly behaved anomaly which is marginally consistent with a null effect.

**47673** (GSI—85-10, pp 649-660) **Search for anomalous fragments of $^{56}$Fe using plastic nuclear track detectors.** Drechsel, H.; Dreute, J.; Brechtmann, C.; Heinrich, W.; Trakowski, W. Mar 1985. B. File Number DE85752251. (CONF-8410210—).

From 7. high energy heavy ion study conference; Darmstadt, F.R. Germany (8 Oct 1984).

We performed an experiment to investigate the anomalous mean free path phenomenon for projectile fragments of $^{56}$Fe. 1846 charge changing collisions of fragments with charges Z = 20 - 25 were analyzed using plastic nuclear track detectors. We observed no evidence for anomalous fragments.

**47674** (GSI—85-10, pp 829-837) **Temperature of particle sources in nucleus-nucleus collisions.** Anikina, M.; Golokhvastov, A.; Iovchev, K.; Khorozov, S.; Kuznetsova, E.; Lukstins, J.; Okonov, E.; Ostanevich, T.; Vardenga, G.; Chkhaidze, L. Mar 1985. B. File Number DE85752251. (CONF-8410210—).

From 7. high energy heavy ion study conference; Darmstadt, F.R. Germany (8 Oct 1984).

Nucleus-nucleus collisions were studied at 4.5 GeV/c/nucleon incident momentum. $^{4}$He, $^{12}$C, $^{16}$O, $^{20}$Ne nuclei were used as projectiles, accelerated in the JINR synchrophasotron, and Li, C, Ne, Al, Cu, Zr, and Pb nuclei were used as internal targets in the 2 m streamer chamber (SKM-200).

**47675** **(INIS-mf—9348) Observation of non-statistical structures in the excitation function of the reaction $^{10}$B($^{14}$N,$^{12}$C)$^{12}$C under extreme forward angles.** Klauss, E.U. (Bochum Univ. (Germany, F.R.). Abt. fuer Physik und Astronomie). 1984. 105p. (In German). NTIS (US Sales Only), PC A06/MF A01. File Number DE85781597.

Diss. (Dr.rer.nat.).

In the present thesis the excitation functions of the reaction $^{10}$B($^{14}$N,$^{12}$C)$^{12}$C to the ground states, the first excited state at 4.43 MeV (Jsup($\pi$) = $2_1^+$) of a $^{12}$C residual nucleus, and to the double excitation of ejectile and residue nucleus to the 4.43 state are studied. The measurements were performed in an energy range 13MeV <= Esub(LAB)($^{14}$N) <= 77.5 MeV under a mean reaction angle near 5° (in the c.m. system). By a fitting to elastic scattering data the optical potential for $^{10}$B+$^{14}$N was determined. With this potential it was tried by means of Hauser-Feshbach calculations to calculate the cross sections of the reaction $^{10}$B($^{14}$N,$^{12}$C)$^{12}$C. The strong $16^+$ resonance and indications of $18^+$ in the excitation function of the reaction $^{10}$B($^{14}$N,$^{12}$Csub(g.s.)) $^{12}$Csub(g.s.) should be pronounced. An unexpected large cross section was observed in the reaction $^{10}$B($^{14}$N,$^{12}$Csub(g.s.)) $^{12}$C($4_1^+$). This is considered as a further indication to the strong contribution of a direct process. (orig./HSI).

**47676** (INIS-mf—9351, pp 572-579) **Fermi $\beta$-decay: An experimental summary.** Koslowsky, V.T.; Azuma, R.E.; Hagberg, E.; Hardy, J.C.; Schmeing, H.; Towner, I.S. (Toronto Univ., Ontario, Canada). 1984. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781594. (CONF-8409143—).

From 7. international conference on atomic masses and fundamental constants (AMCO-7); Darmstadt-Seeheim, F.R. Germany (3 Sep 1984).

Presented here is a survey (to August 1984) of half lives, decay energies and branching ratios for the superallowed $0^+$ -> $0^+$ $\beta$-decay branches from $^{14}$O, sup(26m)Al, $^{34}$Cl, sup(38m)K, $^{42}$Sc, $^{46}$V, $^{50}$Mn and $^{54}$Co. The results are updated and used to calculate Jt values for each transition. The average Jt value for all 8 transitions is 3080.1 +- 2,4 s. (orig.).

**47677** (INIS-mf—9351, pp 36-40) **First observation of $\beta$-delayed triton emission.** Langevin, M.; Detraz, C.; Guillemaud-Mueller, D.; Epherre, M.; Jonson, B.; Thibault, C. (Paris-11 Univ., Orsay, France). 1984. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781594. (CONF-8409143—).

From 7. international conference on atomic masses and fundamental constants (AMCO-7); Darmstadt-Seeheim, F.R. Germany (3 Sep 1984).

The authors have studied the $\beta$-delayed triton emission of $^{11}$Li. From the obtained results together with other results a decay scheme of $^{11}$Li is derived. (HSI).

**47678** (INIS-mf—9351, pp 48-54) **Direct mass mesurements in the light neutron-rich region using a combined energy and time-of-flight technique.** Pillai, C.; Vieira, D.J.; Butler, G.W.; Wouters, J.M.; Rokni, S.H.; Vaziri, K.; Remsberg, L.P. (Oregon State Univ., Corvallis). 1984. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781594. (CONF-8409143—).

From 7. international conference on atomic masses and fundamental constants (AMCO-7); Darmstadt-Seeheim, F.R. Germany (3 Sep 1984).

In the experiment described herein, we have worked to extend mass measurement capabilities one step further with the development of a more general approach in which a whole series of nuclei can be measured simultaneously, independent of their N or Z. Below we demonstrate that direct mass measurements can be performed for fast recoiling nuclei using a combined energy and time-of-flight technique. (orig./HSI).

**47679** (INIS-mf—9351, pp 55-59) **Accurate determination of some nuclear reaction Q-values.** Barker, P.H.; White, R.E.; Lovelock, D.M.J.; Smythe, R.M. (Auckland Univ., New Zealand). 1984. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781594. (CONF-8409143—).

From 7. international conference on atomic masses and fundamental constants (AMCO-7); Darmstadt-Seeheim, F.R. Germany (3 Sep 1984).

The authors have determined the Q values for the superallowed $\beta^+$ decay of $^{38}$Alsup(m) and the reactions $^{7}$Li(p,n)$^{7}$Be, $^{27}$Al(p,n)$^{27}$Si, and $^{26}$Mg(p,n)$^{26}$Alsup(m) at proton energies near threshold. (HSI).

**47680** (INIS-mf—9351, pp 60-67) **Precise determination of Qsub(EC) differences between four pairs of superallowed $\beta$-emitters.** Koslowsky, V.T.; Azuma, R.E.; Clifford, E.T.H.; Hagberg, E.; Hardy, J.C.; Schmeing, H.; Schrewe, U.J.; Sharma, K.S. (Toronto Univ., Ontario, Canada). 1984. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781594. (CONF-8409143—).

From 7. international conference on atomic masses and fundamental constants (AMCO-7); Darmstadt-Seeheim, F.R. Germany (3 Sep 1984).

Qsub(EC)-value differences have been measured for the pairs of superallowed $0^+$ -> $0^+$ $\beta$-emitters sup(26m)Al and $^{14}$O; $^{54}$Co and $^{50}$Mn; $^{42}$Sc and sup(26m)Al; and $^{54}$Co and $^{42}$Sc. By a new high-precision technique we obtain the results 1401.63 +- 0.15 keV, 610.1 +- 0.5 keV, 2193.5 +- 0.2 keV, and 1817.2 +- 0.2 keV, respectively. (orig.).

**47681** (INIS-mf—9351, pp 293-299) **Electromagnetic moments of $^{7}$Li by Coulomb scattering of aligned Li ions.** Weller, A.; Egelhof, P.; Fick, D. (Max-Planck-Institut fuer Kernphysik, Heidelberg, Germany, F.R.). 1984. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781594. (CONF-8409143—).

From 7. international conference on atomic masses and fundamental constants (AMCO-7); Darmstadt-Seeheim, F.R. Germany (3 Sep 1984).

The authors have determined the electric quadrupole moment and the B(E2) values of $^{7}$Li by measurement of the tensor analyzing power in the reactions $^{58}$Ni($^{7}$Li,$^{7}$Li) from 8 to 10 MeV and $^{120}$Sn($^{7}$Li,Li) from 11 to 16 MeV. (HSI).

**47682** (INIS-SU—282, pp 564) **Resonances in elastic scattering and their use in element analysis.** Burkova, I.E.; Yatis, A.A. 1984. (In Russian). NTIS (US Sales Only), PC A99/MF A01. File Number DE85780893. (CONF-8404189—).

From 34. conference on nuclear spectroscopy and nuclear structure; Alma-Ata, USSR (17 Apr 1984).

47683 (INS—488) (α, d) reaction on $^{12}C$ and $^{13}C$ and weak coupling configurations. Yasue, M.; Hamill, J.J.; Bhang, H.C.; Rumore, M.A.; Peterson, R.J. (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). Jan 1984. 59p. NTIS (US Sales Only), PC A04/MF A01. File Number DE85702107.

Cross sections for the (α,d) reaction on $^{12}C$ and $^{13}C$ were measured at E sub(α) = 34.9 MeV in the range of excitation energies up to 11 MeV in $^{14}N$ and up to 16 MeV in $^{15}N$. The angular distributions were compared to calculations with the zero-range distorted-wave Born approximation (DWBA) with the assumption of a deuteron-cluster transfer. On the basis of the assumption that the transferred two nucleons are weakly coupled to the target nuclei, very good correspondences between the transferred angular momenta and the strengths for the two-nucleon pairs were found for the residual nuclei $^{14}N$ and $^{15}N$. Effects of the 0dsub(3/2) shell and a necessity for the tensor force are discussed in terms of the two-nucleon configurations dsub(3/2)psub(1/2) and (dsub(5/2))$^2$, respectively.

47684 (INS—494) Photoemission of two nucleons from $^9Be$ in the Δ(1232) resonance region. Homma, S.; Kanazawa, M.; Koike, M.; Murata, Y.; Okuno, H.; Soga, F.; Yoshikawa, N.; Sasaki, A. (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). Apr 1984. 15p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85702108.

Coincidence measurements of two nucleons from the reactions $^9Be(\gamma,pn)X$ and $^9Be(\gamma,pp)X$ have been made in the Δ(1232) resonance region with a tagged photon beam. From the momentum and angular correlations between two nucleons, two quasifree reactions, $\gamma + "pn" \rightarrow p + n$ and $\gamma + "pp" \rightarrow p + p$, are clearly identified. The separation energy and the momentum distribution of the quasifree deuteron in $^9Be$ are determined together with the ratio between cross sections of two quasifree reactions.

47685 (JAERI-M—84-010, pp 165-176) Evaluation of light nuclides for fusion neutronics application. Shibata, Keiichi (Japan Atomic Energy Research Inst., Tokai, Ibaraki. Tokai Research Establishment). Mar 1984. (In Japanese). NTIS (US Sales Only), PC A13/MF A01. File Number DE84901547. (CONF-8311187—; NEANDC(J)—97/AU; INDC(JPN)—84/G).

From JAERI seminar on nuclear data; Tokai, Japan (30 Nov 1983).

Neutron nuclear data of $^6Li$, $^7Li$, $^{12}C$ and $^{16}O$ have been evaluated for JENDL-3. The methods of evaluation and the results are described. The present evaluated data are employed for the analysis of the Japan-US co-operative experiment using FNS.

47686 (JAERI-M—84-010, pp 269-276) Study of neutron scattering and transmission for light and medium-weight nuclei. Baba, Mamoru (Tohoku Univ., Sendai (Japan)). Mar 1984. (In Japanese). NTIS (US Sales Only), PC A13/MF A01. File Number DE84901547. (CONF-8311187—; NEANDC(J)—97/AU; INDC(JPN)—84/G).

From JAERI seminar on nuclear data; Tokai, Japan (30 Nov 1983).

A brief description is presented for experiments of double-differential neutron emission cross sections measurement. Neutron transmission experiments for various sample thickness are also described.

47687 (JINR—E-1-84-376) Analysis of Λ and associative pion production in relativistic nucleus-nucleus collisions. Anikina, M.; Gazdzicki, M.; Golokhvastov, A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1984. 3p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85702109.

Data on pion, Λ and associative pion production in central nucleus-nucleus collisions at a Momentum of 4.5 GeV/c per incident nucleon obtained using the streamer spectrometer, SKM-200, are analyzed. The results indicate that a single hot source of particles being at rest in the c.m. system in created in events with Λ' s produced beyond the nucleon-nucleon kinematical limit.

## 6514 Nuclear Properties And Reactions, A=20-38, Theoretical

47688 (CEA-CONF—7415) Nuclear fragmentation processes in the $^{20}Ne + ^{27}Al$ system at 30 MeV/u. Morjean, M.; Charvet, J.L.; Uzureau, J.L. (CEA Centre d'Etudes de Bruyeres-le-Chatel, 92 - Montrouge (France)). Aug 1984. 60p. (CONF-8408139—2). NTIS (US Sales Only), PC A02/MF A01. File Number DE85752156.

From INS-RIKEN international symposium on heavy ion physics; Tokyo, Japan (24 Aug 1984).

Fragments produced in the 30 MeV/u $^{20}Ne + ^{27}Al$ reaction have been detected from 5° to 50° between 3 MeV/u and 35 MeV/u. Different origins can be attributed to these fragments.

47689 (CONF-840945—12) Neutron, alpha and total widths and spin assignments for resonances in $^{33}S + N$ from 10-400 keV. Coddens, G.P.; Salah, M.; Harvey, J.A.; Hill, N.W. (Oak Ridge National Lab., TN (USA); Antwerp Univ., Wilrijk (Belgium); Minia Univ. (Egypt)). 1984. Contract AC05-84OR21400. 3p. NTIS, PC A02. File Number DE85017083.

From Topical conference on neutron-nucleus collisions--a probe of nuclear structure; Glouster, OH, USA (5 Sep 1984).

The S-33 neutron total cross section has been measured from 10 keV to 1 MeV. Resonance parameters (E/sub n/, Γ/sub n/, Γ/sub α/, J/sup π/) have been derived in the region from 10 keV to 400 keV.

47690 (GSI—85-10, pp 439-450) Stopping power measurements with 17-GeV/c protons at the AGS or inclusive proton spectra from proton-nucleus interactions at 17 GeV/c. Remsberg, L.P.; Barton, D.S.; Bunce, G.; Carroll, A.S.; Chu, Y.Y.; Cumming, J.B.; Haustein, P.E.; Katcoff, S.; Ludlam, T.; Makdisi, Y.I. Mar 1985. B. File Number DE85752251. (CONF-8410210—).

From 7. high energy heavy ion study conference; Darmstadt, F.R. Germany (8 Oct 1984).

The goal of the experiment was to obtain inclusive proton spectra over the ranges of 0 to 1 GeV/c in Psub(T) and 0 to 1 in xsub(F). The targets used were C, Al, Cu, Ag, and Pb. A limited set of data was also taken with a liquid hydrogen target in order to check some of the calibrations, but this has not yet been analyzed. All of the data from the nuclear targets has been analyzed once, but further refinement is needed. The results available now must therefore be considered preliminary and subject to change, but nevertheless the general features of the results are clear.

47691 (GSI—85-10, pp 477-493) Particle spectra and apparent temperatures. Sandoval, A.; Brockmann, R.; Stock, R.; Stroebele, H.; Bangert, D.; Rauch, W.; Renfordt, R.E.; Schall, D.; Harris, J.W.; Odyniec, G. Mar 1985. B. File Number DE85752251. (CONF-8410210—).

From 7. high energy heavy ion study conference; Darmstadt, F.R. Germany (8 Oct 1984).

Pion and proton emission are used to investigate thermal equilibrium in central collisions of $^{40}Ar + KCl$ at 1.8 GeV/nucleon. The bulk of the yield is isotropic in the c.m. system, the protons have an apparent temperature of 118 MeV while the pions have a much lower temperature of 58 MeV. It is shown that the discrepancy of temperatures can be explained by the decay kinematics of delta resonances in thermal equilibrium as well as by collective radial flow in the expansion stage of the interaction.

47692 (GSI—85-10, pp 801-809) Pion source parameters in heavy ion collisions. Crowe, K.M.; Bistirlich, J.A.; Bossingham, R.R.; Bowman, H.R.; Frankel, K.A.; Humanic, T.J.; Ingersoll, J.G.; Kurck, J.M.; Martoff, C.J.; Murphy, D.L. Mar 1985. B. File Number DE85752251. (CONF-8410210—).

From 7. high energy heavy ion study conference; Darmstadt, F.R. Germany (8 Oct 1984).

We report on measurements of the radius and lifetime of the pion source in the reactions 1.8 GeV/A $^{40}Ar+KCl$ -> 2 πsup(+-

) + X, 1.8 GeV/A $^{20}$Ne + NaF -> 2 $\pi^-$ + X, and 1.71 GeV/A $^{56}$Fe + Fe -> 2 $\pi^-$ + X.

47693 (GSI—85-10, pp 811-828) **Coplanarity of two-proton emissions in 400 MeV/nucleon Ne+NaF, Pb reactions.** Tanihata, I. Mar 1985. B. File Number DE85752251. (CONF-8410210—).

From 7. high energy heavy ion study conference; Darmstadt, F.R. Germany (8 Oct 1984).

Two proton coincidence spectra have been measured in a wide kinematical range for $^{20}$Ne + NaF and $^{20}$Ne + Pb collisions at 400 MeV/nucleon. Coplanar-type correlations show different feature between Ne+NaF and Ne+Pb target reactions. A strong in-plane correlation, which correspond to quasi-elastic scatterings (QES) of nucleons, was observed in wide angular range (15-90°) in NaF target collisions. Angular distributions of QES were reproduced reasonably well by a single nucleon-nucleon scattering model. Enhancement of the QES at momentum transfer around t=2-3msub($\pi$), which is predicted as an indication of pionic instability, was not observed. In Ne+Pb collisions, an azimuthally asymmetric emission of particles with respect to the beam axis were implied by the anti-coplanar correlation. A new type of coplanar correlation between the emission angle and the momentum suggests a back-to-back emission of projectile and target nucleons.

47694 (INIS-mf—9351, pp 210-216) **New measurements of EC/$\beta^+$ ratios and comparison with theory.** Schmidt-Ott, W.D.; Lauerwald, J.; Bosch, U.; Dornhoefer, H.; Schrewe, U.J.; Behrens, H. (Goettingen Univ., Germany, F.R.). 1984. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781594. (CONF-8409143—).

From 7. international conference on atomic masses and fundamental constants (AMCO-7); Darmstadt-Seeheim, F.R. Germany (3 Sep 1984).

The electron-capture to positron-decay ratios, EC/$\beta^+$, and K-capture to positron ratios, K/$\beta^+$, were measured using X- and $\gamma$-ray detectors of high energy resolution and a NaI(Tl) well-type detector of high detection efficiency. Single and coincidence counting was performed. The following results were obtained for allowed transitions: in $^{22}$Na, EC/$\beta^+$ =0.112(7), in $^{52}$Mn, EC/$\beta^+$ =2.27(7), in $^{66}$Zn, K/$\beta^+$ =30.7(11). For a nonunique first-forbidden transition in the decay of $^{161}$Tb with an allowed spectrum shape we measured EC/$\beta^+$ =95.6(52). The experimental ratios were all found to agree with the corresponding recalculated values for allowed transitions. (orig.).

47695 (INIS-mf—9351, pp 580-583) **Half lives of sup(26m)Al, $^{34}$Cl, sup(38m)K: Precision measurements with isotope-separated samples.** Koslowsky, V.T.; Azuma, R.E.; Clifford, E.T.H.; Hagberg, E.; Hardy, J.C.; Schmeing, H.; Schrewe, U.J.; Sharma, K.S.; Evans, H.C. (Toronto Univ., Ontario, Canada). 1984. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781594. (CONF-8409143—).

From 7. international conference on atomic masses and fundamental constants (AMCO-7); Darmstadt-Seeheim, F.R. Germany (3 Sep 1984).

The half-lives of sup(26m)Al, $^{34}$Cl and sup(38m)K have been measured with isotopically pure samples prepared with an on-line isotope separator. The results are 6346.2 +- 2.6 ms, 1527.7 +- 2.2 ms and 924.2 +- 0.3 ms respectively. (orig.).

47696 (INIS-mf—9351, pp 599-604) **Study of the giant Gamow-Teller resonance in nuclear beta-decay: The case of $^{32}$Ar.** Dincklage, R.D. von; Garcia-Borge, M.J.; Ravn, H.L.; Richard-Serre, C.; Ewan, G.T.; Hansen, P.G.; Riisager, K.; Huck, A.; Klotz, G.; Knipper, A. (European Organization for Nuclear Research, Geneva, Switzerland). 1984. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781594. (CONF-8409143—).

From 7. international conference on atomic masses and fundamental constants (AMCO-7); Darmstadt-Seeheim, F.R. Germany (3 Sep 1984).

For $^{32}$Ar, the production was observed at ISOLDE since 1977 but due to the very low yields (proportional 0.2 atom.s$^{-1}$), measurements were limited to the observation of the superallowed Fermi decay to the analog state. A break-through in the target techniques at ISOLDE has allowed to obtain recently a yield of 400 atoms.s$^{-1}$ making possible a detailed analysis of the beta decay, involving $\beta$-delayed protons and gamma rays. This paper gives the results on the distribution and the strength of the GT transitions obtained from this analysis. (orig./HSI).

## 6515 Nuclear Properties And Reactions, A=39-58, Theoretical

*REFER ALSO TO CITATION(S) 47667, 47669, 47676, 47840*

47697 (CEA-CONF—7571) **Transverse and longitudinal response function in deep-inelastic electron scattering from $^{40}$Ca, $^{48}$Ca and $^{56}$Fe.** Meziani, Z.E.; Barreau, P.; Altemus, R. (CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France)). Aug 1984. 2p. (CONF-840789—15). NTIS (US Sales Only), PC A02/MF A01. File Number DE85752162.

From International conference on particles and nuclei; Heidelberg, F.R. Germany (30 Jul 1984).

Pubished in summary form only.

47698 (CONF-850507—52) **$^{58}$Ni + n transmission, capture and differential elastic scattering data analysis in the resonance region.** Perey, C.M.; Perey, F.G.; Harvey, J.A.; Hill, N.W.; Macklin, R.L. (Oak Ridge National Lab., TN (USA)). 1985. Contract AC05-84OR21400. 5p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016157.

From International conference on nuclear data for basic and applied science; Santa Fe, NM, USA (13 May 1985).

High-resolution neutron transmission, capture and differential elastic scattering measurements have been made for $^{58}$Ni-enriched targets at the Oak Ridge Electron Linear Accelerator (ORELA) from the eV to the MeV region. The three sets of data were analyzed simultaneously from 10 to 450 keV, and the transmission analysis was extended to 650 keV. For the 52 s-wave resonances observed between 10 and 650 keV, the average level spacing, $D_0$, and the strength function, $S_0$, are 12.2 +- 1.0 keV and (3.1 +- 0.6) x $10^{-4}$, respectively.

47699 (GSI—85-10, pp 25-44) **Cluster production and entropy.** Gustafsson, H.A.; Gutbrod, H.H.; Kolb, B.; Loehner, H.; Ludewigt, B.; Ritter, H.G.; Warwick, A.; Wieman, H.; Doss, K.G.R.; Poskanzer, A.M. Mar 1985. B. File Number DE85752251. (CONF-8410210—).

From 7. high energy heavy ion study conference; Darmstadt, F.R. Germany (8 Oct 1984).

The experiments, studying 400 and 1050 MeV/nucleon Ca + Ca and 400 and 650 MeV/nucleon Nb + Nb, were carried out at the Berkeley Bevalac. The data were taken with the Plastic Ball/Wall spectrometer. The Plastic Ball covers an angular range of 9 - 160 degrees in the laboratory system and the forward angular range from 0 - 9 degrees is covered by the Plastic Wall. This is in part also used to define the event trigger. The data presented here were taken using both a minimum bias trigger and a central collision trigger.

47700 (GSI—85-10, pp 783-799) **Two particle correlations from relativistic nuclear collisions.** Wieman, H.; Doss, K.G.R.; Gustafsson, H.A.; Gutbrod, H.H.; Kolb, B.; Loehner, H.; Ludewigt, B.; Poskanzer, A.M.; Renner, T.; Ritter, H.G. Mar 1985. B. File Number DE85752251. (CONF-8410210—).

From 7. high energy heavy ion study conference; Darmstadt, F.R. Germany (8 Oct 1984).

Two particle correlations at low relative momentum have been examined using the Plastic Ball detector for the system 400 MeV/nucleon Ca + Ca. The unbound $^5$Li ground state yield has been extracted from the p-$^4$He correlation and compared with a Chemical Equilibrium model along with the yield of light bound clusters. Source-size radii were measured for both Ca + Ca and Nb + Nb, at 400 MeV/nucleon from p-p correlations. The radii were found to have a cube-root dependence on the proton multiplicity of the event and the deduced thermal freezeout density was found to be about 25% of normal nuclear matter density.

47701 (INIS-mf—9351, pp 75-81) **Mass excesses from 3 particle transfer reactions.** Brauner, M.; Gyufko, R.; Kolbert, D.; Kruechten, B. v.; Wiedner, C.A.; Thornton, S.T. (Max-Planck-Institut fuer Kernphysik, Heidelberg, Germany, F.R.). 1984. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781594. (CONF-8409143—).

From 7. international conference on atomic masses and fundamental constants (AMCO-7); Darmstadt-Seeheim, F.R. Germany (3 Sep 1984).

The mass excesses of $^{51}$Ca and $^{147}$Tb were determined by a measurement of the Q-values of the $^{48}$Ca($^{18}$O, $^{15}$O)$^{51}$Ca and $^{144}$Sm($^{14}$N, $^{11}$Be)$^{147}$Tb reactions. (orig./HSI).

47702 (INIS-mf—9351, pp 82-88) **Mass measurements of $^{59}$Zn and $^{57}$Cu.** Sherrill, B.; Beard, K.; Benenson, W.; Bloch, C.; Brown, B.A.; Kashy, E.; Nolen, J.A. Jr.; Panagiotou, A.D.; Plicht, J. van der; Winfield, J.S. (Michigan State Univ., East Lansing). 1984. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781594. (CONF-8409143—).

From 7. international conference on atomic masses and fundamental constants (AMCO-7); Darmstadt-Seeheim, F.R. Germany (3 Sep 1984).

The authors have determined the mass excesses of $^{59}$Zn and $^{57}$Cu by the measurement of the Q-values of the reactions $^{58}$Ni(p,$\pi^-$)$^{59}$Zn and $^{58}$Ni($^7$Li, $^8$Me)$^{57}$Cu, respectively. (HSI).

47703 (INIS-SU—301, pp 152-156) **Radiative and neutron strength functions of spherical nuclei.** Voronov, V.V.; Solov'ev, V.G. (Joint Inst. for Nuclear Research, Dubna, USSR). 1984. (In Russian). NTIS (US Sales Only), PC A18/MF A01. File Number DE85781590. (CONF-8310228—Vol.1).

From 6. Soviet national conference on neutron physics; Kiev, USSR (10 Oct 1983).

The radiative and neutron strength functions of $^{56}$Fe, sup(59,61)Ni and sup(207,208)Pb spherical nuclei are calculated within the quasiparticle-phonon model. The contribution of the vatence transitions to the partial E1- and M1-widths in sup(59,61)Ni is investigated. The energy dependence of neutron strength functions in sup(207,208)Pb is correctly described up to 0.9 MeV above the neutron binding energy. 7 references, 1 figure, 1 table.

47704 (INIS-SU—301, pp 157-162) **Role of E1- and M1-transitions in the γ-decay following neutron capture in sup(58,60)Ni and sup(56)Fe.** Reffo, G.; Fabbri, F. (Comitato Nazionale per l'Energia Nucleare, Bologna, Italy). 1984. NTIS (US Sales Only), PC A18/MF A01. File Number DE85781590. (CONF-8310228—Vol.1).

From 6. Soviet national conference on neutron physics; Kiev, USSR (10 Oct 1983).

Detailed calculations are presented of E1- and M1-transition contributions to average total radiative width and to average total γ-ray spectra following s-, p-, d-wave neutron capture in the resonance region of sup(58,60)Ni and $^{56}$Fe. The Brink-Axel model is used for γ-ray transitions taking place via compound nucleus mechanism. It is noted that M1-transition contributions cannot be neglected in theoretical calculations. 10 references, 2 figures, 3 tables.

47705 (INIS-SU—301, pp 176-180) **Effect of momentum and parity conservation laws on the calculation of neutron emission spectra.** Bychkov, V.M.; Pashchenko, A.B.; Plyaskin, V.I. (Fiziko-Ehnergeticheskij Inst. Obninsk, USSR). 1984. (In Russian). NTIS (US Sales Only), PC A18/MF A01. File Number DE85781590. (CONF-8310228—Vol.1).

From 6. Soviet national conference on neutron physics; Kiev, USSR (10 Oct 1983).

The influence of γ-ray emission and the laws of conservation of parity and angular momentum upon calculations of (n2n) reaction excitation function and emission spectra have been investigated in the framework of Hauser-Feshbach-Moldauer's formalism. The calculations are carried out for the $^{56}$Fe(n,2n)$^{55}$Fe reaction. It is concluded that the description of neutron spectra in the evaporation model is in agreement with the analogues calculations according to the Hauser-Feshbach-Nolduer formula at the energies of several MeV higher than the (n,2n) reaction threshold. 10 references, 4 figures.

47706 **Primary projectile fragmentation distribution in high energy heavy ion collisions.** Kitazoe, Yasuhiro; Hashimoto, Osamu; Toki, Hiroshi; Yamamura, Yasunori; Sano, Mitsuo. (Lawrence Berkeley Lab., CA). *Progress of Theoretical Physics (Kyoto);* **71**: No. 6, 1429-1431(Jun 1984).

## 6516 Nuclear Properties And Reactions, A=59-89, Theoretical

47707 (GSI—85-10, pp 599-615) **Unusual behavior of projectile fragments formed in the bombardment of copper with relativistic Ar ions.** Dersch, G.; Beckmann, R.; Feige, G.; Lund, T.; Vater, P.; Brandt, R.; Ganssauge, E.; Aleklett, K.; Friedlander, E.M.; McGaughey, P.L. Mar 1985. B. File Number DE85752251. (CONF-8410210—).

From 7. high energy heavy ion study conference; Darmstadt, F.R. Germany (8 Oct 1984).

The interaction properties of projectile fragments from the fragmentation of 0.9 A GeV and 1.8 A GeV $^{40}$Ar with Cu have been studied using radioactivation techniques. Projectile fragments formed in the interaction of the primary Ar beam with a thick Cu disk (the target disk) interacted with a second detector Cu disk. The relative reaction product yields in the two disks were measured as a function of the separation between the disks. A large increase in the yield of deep spallation products ($^{24}$Na, $^{28}$Mg) in the detector disk was observed as the projectile energy increased from 0.9 A GeV to 1.8 A GeV. At 1.8 A GeV (but not at 0.9 A GeV) the yields of the deep spallation products descreased as the separation between the disks increased indicating either a dramatic broadening of the relevant projectile fragment angular distribution between 0.9 A GeV and 1.8 A GeV or decay in flight of some of the projectile fragments at 1.8 A GeV (but not at 0.9 A GeV). Calculations will be discussed that cast doubt on the first possibility.

47708 (GSI—85-10, pp 753-759) **Electromagnetic dissociation of target nuclei.** Hill, J.C.; Mercier, M.T.; Wohn, F.K.; Smith, A.R. Mar 1985. B. File Number DE85752251. (CONF-8410210—).

From 7. high energy heavy ion study conference; Darmstadt, F.R. Germany (8 Oct 1984).

Electromagnetic dissociation of $^{59}$Co, $^{89}$Y, and $^{197}$Au target nuclei by the Coulomb field of relativistic heavy ions (RHI) was inferred from measurement of one-neutron removal cross sections. The projectiles ranged from 2.1-GeV protons to 1.7-GeV/nucleon $^{56}$Fe. In most cases the experimental cross sections in excess of the estimated nuclear contributions are well described by use of the Weizsaecker-Williams method for calculating the electromagnetic dissociation contributions.

47709 (GSI—85-10, pp 771-781) **Multi-pion production.** Beavis, D.; Fung, S.Y.; Gorn, W.; Keane, D.; Liu, Y.M.; Poe, R.T.; VanDalen, G.; Vient, M. Mar 1985. B. File Number DE85752251. (CONF-8410210—).

From 7. high energy heavy ion study conference; Darmstadt, F.R. Germany (8 Oct 1984).

Preliminary analysis of pion production in 1.2 GeV/nucleon Kr-RbBr collisions is presented. The negative pion multiplicity is consistent with a convolution of Poisson distributions and a freeze-out density between 1/3 and 1/2 normal nuclear density is extracted. Global negative pion kinematic variables are used to search for possible structure in the multi-pion emission. No evidence for structured emission or conservation constraints is found. Pion interferometry analysis gives a source radius of 5.4 +- 1.2 Fermi and a freeze-out density of .3 +- .2 times normal nuclear density.

47710 **(GSI—85-18-Prepr.) Fusability and fissionability in $^{86}$Kr induced reactions near and below the fusion barrier.** Reisdorf, W.; Hessberger, F.P.; Hildenbrand, K.D.; Hofmann, S.; Muenzenberg, G.; Schmidt, K.H.; Schneider, W.F.W.; Suemmerer, K.; Wirth, G.; Kratz, J.V. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)). Apr 1985. 57p. NTIS (US Sales Only), PC A04/MF A01. File Number DE85752336.

Evaporation-residue excitation functions for the reactions $^{86}$Kr + sup(70,76)Ge, sup(92,100)Mo, sup(99,102,104)Ru have been

measured using activation methods and the velocity filter SHIP. The data span the region from well below the fusion barrier up to and beyond the energy where limitation by fission competition takes place. The data are shown to be compatible with the concept of complete fusion followed by the statistical decay of the equilibrated compound nucleus. Information on both the fusion probability at and below the fusion threshold and the fissionability of the compound nuclei formed is extracted. The model dependence of the extracted fission barriers is discussed in detail. In analogy to studies involving lighter projectiles, strong correlations between the low-energy nuclear-structure properties of the nuclei and the sub-barrier fusion probability are found. A relative shift of the fusion barrier to higher energies, that increases with the number of valence neutrons in the target nuclei, is observed.

47711 (INIS-mf—9351, pp 89-94) **$^{71}$Ge Qsub(EC) value and the neutrino capture cross section for the gallium solar neutrino detector.** Hampel, W.; Schlotz, R. (Max-Planck-Institut fuer Kernphysik, Heidelberg, Germany, F.R.). 1984. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781594. (CONF-8409143—).

From 7. international conference on atomic masses and fundamental constants (AMCO-7); Darmstadt-Seeheim, F.R. Germany (3 Sep 1984).

The Qsub(EC) value of $^{71}$Ge, an important quantity for the proposed Gallium Solar Neutrino Detector, has been redetermined. The best value is now 233.2 +- 0.5 keV. (orig.).

47712 (INIS-mf—9351, pp 95-101) **Recent mass measurements by $^{14}$C induced transfer reactions.** Bernas, M.; Dessagne, P.; Langevin, M.; Pougheon, F.; Roussel, P.; Parrot, G.; Quiniou, E.; Schmidt-Ott, W.D. (Paris-11 Univ., Orsay, France). 1984. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781594. (CONF-8409143—).

From 7. international conference on atomic masses and fundamental constants (AMCO-7); Darmstadt-Seeheim, F.R. Germany (3 Sep 1984).

The authors describe the measurement of the mass and excited level energies of sup(67,68)Ni by the reaction of $^{14}$C with $^{70}$Ge together with the determination of the half-life of the $O_5^+$ state of $^{68}$Ni. (HSI).

47713 (INIS-mf—9351, pp 112-118) **Neutron deficient mass surface between the 1fsub(7/2) and 1gsub(9/2) shells: the masses of $^{77}$Kr and $^{75}$Kr.** Moltz, A.; Sullivan, J.D.; Tribble, R.E.; Gagliardi, C.A.; Toth, K.S.; Avignone, F.T. III. (South Carolina Univ., Columbia). 1984. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781594. (CONF-8409143—).

From 7. international conference on atomic masses and fundamental constants (AMCO-7); Darmstadt-Seeheim, F.R. Germany (3 Sep 1984).

The masses of $^{77}$Kr and $^{75}$Kr have been measured utilizing the sup(80,78)Kr($^3$He,$^6$He) reactions at E3sub(He) = 70 MeV. These new results have been integrated into the total scheme of mass measurements in the light rubidium and krypton isotopes commenced several years ago. Comparisons with several mass formulae have also been made. (orig.).

47714 (INIS-mf—9351, pp 119-126) **New mass-spectrometric measurements of exotic alkali isotopes.** Audi, G.; Coc, A.; Epherre, M.; Le Scornet, G.; Thibault, C.; Touchard, F. (Centre National de la Recherche Scientifique, Orsay, France). 1984. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781594. (CONF-8409143—).

From 7. international conference on atomic masses and fundamental constants (AMCO-7); Darmstadt-Seeheim, F.R. Germany (3 Sep 1984).

We report here new measurements performed with the double focussing mass spectrometer, the performance of which has been upgraded, in order to measure more exotic nuclei provided by the ISOLDE facility at CERN and to separate isobars and contaminants more efficiently. (orig./HSI).

47715 (INIS-mf—9351, pp 127-133) **Determination of (Qsub($\beta$)-Bsub(n)) values of neutron-rich A=90 and 140 nuclei.** Kratz, K.L.; Schroeder, A.; Ohm, H.; Gabelmann, H.; Ziegert, W.; Steinmueller, B.; Pfeiffer, B. (Mainz Univ., Germany, F.R.). 1984. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781594. (CONF-8409143—).

From 7. international conference on atomic masses and fundamental constants (AMCO-7); Darmstadt-Seeheim, F.R. Germany (3 Sep 1984).

We have extracted (Qsub($\beta$)-Bsub(n)) values of neutron-rich nuclei in the A = 90 and 140 mass regions by comparing experimental delayed neutron spectra with theoretical spectra from a statistical model. In order to approach a procedure for deriving reliable end point energies from such a treatment, the influence of the numerous parameters entering the calculations on the neutron spectrum shape has been investigated in detail. (orig./HSI).

47716 (INIS-mf—9351, pp 300-306) **Very large deformation of $^{77}$Rb.** Lister, C.J.; Varley, B.J.; Luehmann, L.; Lieb, K.P.; Price, H.G.; Olness, J.W. (Manchester Univ., England). 1984. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781594. (CONF-8409143—).

From 7. international conference on atomic masses and fundamental constants (AMCO-7); Darmstadt-Seeheim, F.R. Germany (3 Sep 1984).

The motivation to study the high spin spectrum and transition strengths in $^{77}$Rb and to extent the former work on this nucleus (10) was to determine the quadrupole deformation via the measurement of lifetimes up to high spins. (orig./HSI).

47717 (INIS-SU—301, pp 163-166) **Importance of valence mechanism in neutron capture.** Reffo, G.; Fabbri, F.; Mengoni, A. (Comitato Nazionale per l'Energia Nucleare, Bologna, Italy). 1984. NTIS (US Sales Only), PC A18/MF A01. File Number DE85781590. (CONF-8310228—Vol.1).

From 6. Soviet national conference on neutron physics; Kiev, USSR (10 Oct 1983).

The role of the valence mechanism in neutron capture is illustrated by the example of the neutron radiative capture calculation at 30 keV on $^{86}$Kr. One finds that at 30 keV the valence contribution to neutron capture is negligible because it affects only a few channels feeding the lower lying levels in $^{87}$Kr. On the contrary the compound nucleus contribution dominates. 6 references, 1 table.

47718 (INIS-SU—301, pp 185-190) **Mechanism of inelastic scattering of fast neutrons and characteristics of $^{59}$Co and $^{209}$Bi excited levels.** Simakov, S.P.; Lovchikova, G.N.; Lunev, V.P.; Sal'nikov, O.A.; Titarenko, N.N. (Fiziko-Ehnergeticheskij Inst., Obninsk, USSR). 1984. (In Russian). NTIS (US Sales Only), PC A18/MF A01. File Number DE85781590. (CONF-8310228—Vol.1).

From 6. Soviet national conference on neutron physics; Kiev, USSR (10 Oct 1983).

The theoretical analysis of neutron inelastic scattering cross-sections in the energy range 5-8 MeV on $^{59}$Co and $^{209}$Bi nuclei are made. Calculations have done in the framework of equilibrium and direct mechanisms using Hauser and Feshbach model and Born approximation of distorted waves. From the analysis of the equilibrium part of the cross section the nuclear energy-level density parameters and moments of inertia of the $^{59}$Co and $^{209}$Bi nuclei in excited states are determined. 15 references, 2 figures, 2 tables.

47719 (JINR—3-84-484) **Search for (n, $\alpha$) reaction on radioactive nuclei at neutron resonance energies.** Balabanov, N.P.; Zvarova, T.S.; Lebedev, N.A.; Marinova, S.G.; Mitrikov, M.P.; Mitrikova, R.S.; Popov, Yu.P.; Salatskij, V.I. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics). 1984. 10p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE85702110.

The description and results of first attempts of detecting the (n, $\alpha$) reaction on $^{65}$Zn and $^{149}$Sm radioactive isotopes are given. The measurements have been performed at neutron beams of the IBR-30 reactor by means of semiconductor detectors and ionization chamber. The estimations of upper limits of the B=2g(GITAsub(n)

GITAsub(α)/GITA) parameter and the upper estimations of the contributions of possible resonances into the cross section for thermal point ($\sigma$) are obtained. For $^{68}$Zn at Esub(n)=35 - 40 eV neutron energy the parameter B <= 4 x $10^{-3}$ and s <= 1.5 barn, at Esub(n)=115 - 130 eV B <= 4.6 x $10^{-2}$ and $\sigma$ <= 1.7, at E=650 - 750 eV B <= 2.1 and s <= 2.1. The prospect for further investigations of (n, α) reaction on radioactive nuclei is discussed.

47720 **Unusual behavior of projectile fragments from the interaction of copper with relativistic Ar ions.** Dersch, G.; Beckmann, R.; Feige, G.; Lund, T.; Vater, P.; Brandt, a.R.; Ganssauge, E.; Aleklett, K.; Friedlander, E.M.; McGaughey, P.L. (Kernchemie Physik, Philipps Universitat, 3550 Marburg, Federal Republic of Germany). *Physical Review Letters;* 55: No. 11, 1176-1179(9 Sep 1985).

Projectile fragments formed in the interaction of 0.9A-GeV and 1.8A-GeV $^{40}$Ar ions with a Cu disk interact with a second Cu disk and the relative yields of products in the two disks are measured by radioactivation techniques as a function of the distance between them. The data at 1.8A-GeV demand either (1) decay in flight (t/sub 1/2/roughly-equal$10^{-10}$ s) of some projectile fragments having large cross sections or (2) production of secondaries with unexpectedly large transverse momenta.

47721 **Shell model study of sup(90,88)Zr.** Becker, J.A.; Bloom, S.D. (California Univ., Livermore (USA). Lawrence Livermore National Lab.); Warburton, E.K. (Brookhaven National Lab., Upton, NY (USA)). pp 737-748 of Proceedings of the International symposium on in-beam nuclear spectroscopy held at Debrecen, Hungary, 14-18 May 1984. Vol. 2. Dombradi, Zs.; Fenyes, T. (eds.). Budapest, Hungary; Akademiai Kiado (1984). (CONF-840530—Vol.2).

From International symposium on in-beam nuclear spectroscopy; Debrecen, Hungary (14 May 1984).

Conventional spherical shell model calculations have been undertaken to describe sup(90)Zr and sup(88)Zr. Valence orbitals included the 1fsub(5/2), 2psub(3/2), 2psub(1/2), and 1gsub(9/2) for protons, and 1gsub(9/2) and 2dsub(5/2) for neutrons. For sup(90)Zr, the number of 1gsub(9/2) protons was <2. For the high spin even parity states of sup(90)Zr, two calculations were performed, one with <4 (0) gsub(9/2) protons (neutron holes) and one with <2 (2) gsub(9/2) protons (neutron holes). For sup(88)Zr, the number of particles in the gsub(9/2) shell was restricted to <10. For the high spin negative parity states, a calculation was done with up to 11 particles in the gsub(9/2) shell. A realistic two-body interaction was employed in this calculation. Predicted excitation energies are compared with experimental results, and for the lower lying positive parity states a comparison of electromagnetic transition rates is also made.

## 6517 Nuclear Properties And Reactions, A=90-149, Theoretical

*REFER ALSO TO CITATION(S) 47721, 47761, 47777, 47840, 47840*

47722 (GSI—85-10, pp 387-395) **Light particle emission at large angles in 0.8 A GeV La + La collisions.** Miake, Y. Mar 1985. B. File Number DE85752251. (CONF-8410210—).

From 7. high energy heavy ion study conference; Darmstadt, F.R. Germany (8 Oct 1984).

We have measured inclusive spectra of light fragments and negative pions in the ($_{57}^{139}$)La + ($_{57}^{139}$)La collisions.

47723 (GSI—85-10, pp 397-402) **Neutron emission at forward angles from collisions of 800 MeV/A niobium ions on niobium.** Madey, R.; Anderson, B.D.; Baldwin, A.R.; Flanders, B.S.; Pairsuwan, W.; Varga, J.; Watson, J.W.; Westfall, G. Mar 1985. B. File Number DE85752251. (CONF-8410210—).

From 7. high energy heavy ion study conference; Darmstadt, F.R. Germany (8 Oct 1984).

We measured neutron time-of-flight spectra at nine angles (viz., 0, 4, 8, 15, 30, 42, 90, 120, and 160 deg.) from collisions of niobium ions with an energy of 800 MeV per nucleon at the center of a (1.37 gm/cm$^2$) niobium target oriented at an angle of 45 deg. with respect to the direction of the incident beam.

47724 (GSI—85-10, pp 429-438) **Nuclear reactions in emulsion induced by 12 GeV/A α - particles from the CERN PS.** Lund, I. Mar 1985. B. File Number DE85752251. (CONF-8410210—).

From 7. high energy heavy ion study conference; Darmstadt, F.R. Germany (8 Oct 1984).

Preliminary results from an experiment with α - particles at 12 A GeV and with Nuclear Emulsion as active target will be presented. The central events are given special attention in this presentation.

47725 (GSI—85-10, pp 545-549) **Evidence against anomalon production in high-energy heavy-ion collisions.** Stevenson, J.D.; Musser, J.A.; Barwick, S.W.; Tincknell, M.L. Mar 1985. B. File Number DE85752251. (CONF-8410210—).

From 7. high energy heavy ion study conference; Darmstadt, F.R. Germany (8 Oct 1984).

This report is a follow-up to experiments performed in October, 1983 at the Lawrence Berkeley Laboratory Bevalac. These experiments used a 14 element Lucite Cherenkov detector telescope to observe charge-changing fragmentation reactions of 1.8 GeV/A $^{40}$Ar and 2.1 GeV/A $^{20}$Ne. No evidence for any short mean-free-path component was found among the combined almost 155000 secondary interactions. A search for fractionally charged nuclei among almost 22000 projectile fragments found none differing in charge from integer values by more than +-1/3e. Here these results are recapitulated, and a few new details are presented.

47726 (GSI—85-10, pp 573-583) **Search for anomalous fragments in 1.8 GeV/A $^{40}$Ar reactions in nuclear emulsions.** Garpman, S.I.A. Mar 1985. B. File Number DE85752251. (CONF-8410210—).

From 7. high energy heavy ion study conference; Darmstadt, F.R. Germany (8 Oct 1984).

We have investigated the mean free path (mfp) in nuclear emulsion of multiply charged fragments, produced by 1.8 GeV/A Argon nuclei.

47727 (GSI—85-10, pp 585-591) **Interaction properties of secondary Z >= 2 nuclei from 4.5 GeV/A carbon collisions in nuclear emulsions.** Baican, B.; Baumgardt, H.G.; Schopper, E.; Friedlander, E.M. Mar 1985. B. File Number DE85752251. (CONF-8410210—).

From 7. high energy heavy ion study conference; Darmstadt, F.R. Germany (8 Oct 1984).

A stack of Br-2 electron sensitive emulsions (10 x 20 x 0.06 cm each) was exposed to the 4.5 Gev/A $^{12}$C-beam of the JINR synchrophasotron at Dubna. The beam fluence was 2.5*10$^4$/cm$^2$; the minimum grain density was 19/100 um. The primary carbon nuclei were scanned along the track under 45x objectives until they interacted or up to a maximum distance $D_0$ = 5 cm; event analysis was done with 100x immersion objectives. Interactions were defined by the emission of at least one hadronic track. The secondaries were identified by measurement of mean gap-length for 2 <= Z <= 3, and of delta-ray density for Z = 4-6.

47728 (GSI—85-10, pp 593-598) **About a possible correlation between two different reaction mechanisms in relativistic heavy-ion collisions and anomalously short mean free pathes.** Ganssauge, E.; Kallies, H.; Mueller, C.; Schulz, W. Mar 1985. B. File Number DE85752251. (CONF-8410210—).

From 7. high energy heavy ion study conference; Darmstadt, F.R. Germany (8 Oct 1984).

We have studied 371 primary stars of 56-Fe projectiles at 1.9 GeV/u in ILFORD G5 nuclear research emulsion with at least one alpha particle emerging as relativistic projectile fragment.

**47729** (GSI—85-10, pp 617-648) **Angular and multiplicity correlation and nature of anomalon Z=2 fragments from $^{12}C$, $^{22}Ne$, and $^{40}Ar$ relativistic projectiles. New experimental observation in $\pi^-$-interaction in nuclear emulsions.** El-Nadi, M.; Badawy, O.E.; Mettwalli, N.M.; El-Nagdy, M.S.; El-Bakry, M.; Sadek, N.; Mosaad, M.M.; El-Sourogy, A.; Abdel-Salam, A.; El-Hamalawy, A.A. Mar 1985. B. File Number DE85752251. (CONF-8410210—).

From 7. high energy heavy ion study conference; Darmstadt, F.R. Germany (8 Oct 1984).

Short M.F.P. components of Z = 2 P.F.S. from $^{12}C$ and $^{22}Ne$-relativistic ions with fractional ratios of 26.00% and 22.00% are respectively observed in the angular range of emission $0.25^0 <$ theta $<= 0.64^0$. Beside that angular correlation of anomalon production, a dependence on the fragment multiplicity is also detected. Enhanced production of Lepton pairs is observed in secondary events due to these anomalon fragments. The Z = 2 $^{40}Ar$ fragments at LBL energy showed no signal for anomalon production. New experimental observations about interactions of $\pi^-$ in emulsion at 340 Gev/c are reported.

**47730** (GSI—85-10, pp 661-669) **Search for anomalon (Z=2) in 4.5 GeV/n $C^{12}$ - Em interaction.** Ghosh, D.; Roy, J.; Banerjee, D.; Sengupta, R.; Sengupta, K.; Dutta, A.; Naha, S. Mar 1985. B. File Number DE85752251. (CONF-8410210—).

From 7. high energy heavy ion study conference; Darmstadt, F.R. Germany (8 Oct 1984).

In this paper we present the results of our search for anomalous (the projectile fragments with anomalous interaction mean free path) in projectile fragments of Z = 2 from 4.5 GeV/c/n, $C^{12}$ projectile by using Nuclear emulsion.

**47731** (GSI—85-10, pp 707-717) **Nuclear percolation.** Campi, X.; Desbois, J. Mar 1985. B. File Number DE85752251. (CONF-8410210—).

From 7. high energy heavy ion study conference; Darmstadt, F.R. Germany (8 Oct 1984).

Nuclear multifragmentation and spallation reactions produced in medium and high energy collisions are viewed as a percolation phenomenon. Percolation criteria are defined in both real and momentum space and a compactness condition is imposed to the clusters. Under these conditions, nuclear systems behave like a two-dimensional site percolation model, exhibiting a rather well defined percolation threshold at psub(c) approx.= 0.6. The concentration p is correlated with the number of fast particles ejected in the first stage of the collision. The mass yield results from the superposition of cluster size distributions at different values of p.

**47732** (GSI—85-10, pp 727-739) **Fragmentation instabilities in nuclear systems.** Panagiotou, A.D. Mar 1985. B. File Number DE85752251. (CONF-8410210—).

From 7. high energy heavy ion study conference; Darmstadt, F.R. Germany (8 Oct 1984).

We present experimental evidence for fragmentation instabilities, which possibly support the notion of a Liquid-Gas (L-G) phase transition in the expanding hot nuclear system.

**47733** (INIS-mf—9351, pp 314) **Nuclear level mixing resonances on oriented nuclei (LMR/ON).** Berkes, I.; Hlimi, B.; Marest, G.; Sau, J.; Sayouty, E.H.; Coussement, R.; Hardeman, F.; Put, P.; Scheveneels, G. (Lyon-1 Univ., Villeurbanne, France). 1984. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781594. (CONF-8409143—).

From 7. international conference on atomic masses and fundamental constants (AMCO-7); Darmstadt-Seeheim, F.R. Germany (3 Sep 1984).

**47734** (INIS-mf—9351, pp 530-536) **Possible decay modes of proton-rich nuclei around $^{100}Sn$.** Ogawa, K. (Tokyo Univ., Tanashi, Japan). 1984. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781594. (CONF-8409143 —).

From 7. international conference on atomic masses and fundamental constants (AMCO-7); Darmstadt-Seeheim, F.R. Germany (3 Sep 1984).

I present the results of shell-model calculations for the proton-rich nuclei around the $^{100}Sn$ mass region and discuss the possible existence of the proton radioactivity in this mass region. (orig./HSI).

**47735** (INIS-mf—9351, pp 134-140) **Precise Qsub($\beta$)-measurements for A=95, 96, 97, 98 mass chains with a GE(HP)-detector-telescope.** Bloennigen, F.; Pfeiffer, B.; Bewersdorf, G.; Geisse, C.; Lippert, W.; Stoehlker, U.; Wollnik, H. (Institut Max von Laue - Paul Langevin, Grenoble, France). 1984. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781594. (CONF-8409143—).

From 7. international conference on atomic masses and fundamental constants (AMCO-7); Darmstadt-Seeheim, F.R. Germany (3 Sep 1984).

Recent results of Qsub($\beta$)-values of the mass chains A = 95, 96, 97 and 98, obtained with a Ge(HP)-gas $\Delta$E telescope are presented and compared to the results, obtained by Qsub($\beta$) measurements with plastic scintillator telescopes and by direct mass measurements. All our measurements were performed at the OSTIS online separator. The Qsub($\beta$)-values we found are in very good agreement with the direct mass measurements for sup(95,97,98)Rb while in $^{96}Rb$ is still a discrepancy of 240 keV. (orig.).

**47736** (INIS-mf—9351, pp 141-147) **Beta decay energies of sup(98,99)Rb, sup(99,100)Sr and $^{100}y$.** Iafigliola, R.; Dautet, H.; Xu, S.W.; Lee, J.K.P.; Chrien, R.; Gill, R.; Shmid, M. (McGill Univ., Montreal, Quebec, Canada). 1984. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781594. (CONF-8409143—).

From 7. international conference on atomic masses and fundamental constants (AMCO-7); Darmstadt-Seeheim, F.R. Germany (3 Sep 1984).

In this study we have extracted $\beta$-endpoint energy values from single $\beta$-spectra obtained using a solid state beta telescope system. Qsub($\beta$) values were then deduced based on the available decay scheme information. (orig./HSI).

**47737** (INIS-mf—9351, pp 148-154) **Study of nuclear structure effects in the mass region A approx.= 100 by means of beta-decay energies.** Keyser, U.; Muennich, F.; Pahlmann, B.; Graefenstedt, M.; Faust, H.; Weikard, H.; Pfeiffer, B. (Technische Univ. Braunschweig, Germany, F.R.). 1984. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781594. (CONF-8409143—).

From 7. international conference on atomic masses and fundamental constants (AMCO-7); Darmstadt-Seeheim, F.R. Germany (3 Sep 1984).

The Qsub($\beta$) values of 16 nuclei with mass number 99 <= A <= 106 have been measured recently at the mass separators OSTIS and LOHENGRIN. This work is part of a systematic investigation of very neutron-rich nuclei in the mass region around A approx.= 100 in order to study systematically the transition from shell closure (sphericity) to deformation, which takes place in this part of the nuclear chart. In a plot of the two-neutron binding energies calculated from these Qsub($\beta$)-values, the onset of the subshell closure at N = 56 and the deformation at N = 60 as a function of the nuclear charge is easily observed. (orig.).

**47738** (INIS-mf—9351, pp 163-169) **Accurate mass determination of neutron deficient indium nuclei.** Bom, V.R.; Coops, P.C.; Hollander, R.W.; Coenen, E.; Deneffe, K.; Duppen, P. van; Huyse, M. (Technische Hogeschool Delft, Netherlands). 1984. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781594. (CONF-8409143—).

From 7. international conference on atomic masses and fundamental constants (AMCO-7); Darmstadt-Seeheim, F.R. Germany (3 Sep 1984).

The $\beta^+$-spectra of the neutron deficient indium nuclei, with mass number from 108 down to 103, have been measured using a solid state beta detector. The activities, produced in heavy ion reactions, have been separated. The nuclear masses have been determined from the endpoint energies. The mass of $^{103}In$ shows a marked deviation from the value predicted by systematics. (orig.).

47739 (INIS-mf—9351, pp 170-176) **From Q-value measurements to mass and structure of proton-rich nuclei in the tin region.** Grant, I.S.; Kirchner, R.; Klepper, O.; Koslowsky, V.T.; Rathke, G.E.; Roeckl, E.; Rykaczewski, K.; Schardt, D.; Larsson, P.O.; Nyman, G. (Manchester Univ., England). 1984. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781594. (CONF-8409143—).

From 7. international conference on atomic masses and fundamental constants (AMCO-7); Darmstadt-Seeheim, F.R. Germany (3 Sep 1984).

The authors have measured the electron capture decay energies for the isotopes sup(108,) sup(106,) $^{104}$Sn, $^{90}$Pd, and $^{111}$Te. From these values the mass defects were derived. For $^{105}$Sn an improved half-live of 28 + 35 was obtained. (HSI).

47740 (INIS-mf—9351, pp 177-183) **Two new proton radioactivities: $^{109}$I and $^{113}$Cs.** Faestermann, T.; Gillitzer, A.; Hartel, K.; Kienle, P.; Nolte, E. (Technische Univ. Muenchen, Garching, Germany, F.R.). 1984. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781594. (CONF-8409143—).

From 7. international conference on atomic masses and fundamental constants (AMCO-7); Darmstadt-Seeheim, F.R. Germany (3 Sep 1984).

We briefly describe the experimental setup, which allows to measure proton- (or alpha-) decay with halflifes as short as 10 ns. Then we present the results for the three nuclei studied and we discuss their decay energies and questions concerned with their halflifes in the last section. (orig./HSI).

47741 (INIS-mf—9351, pp 184-195) **Experiments on proton radioactivity.** Hofmann, S.; Agarwal, Y.K.; Armbruster, P.; Hessberger, F.P.; Larsson, P.O.; Muenzenberg, G.; Poppensieker, K.; Reisdorf, W.; Schneider, J.R.H.; Schoett, H.J. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt, Germany, F.R.). 1984. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781594. (CONF-8409143—).

From 7. international conference on atomic masses and fundamental constants (AMCO-7); Darmstadt-Seeheim, F.R. Germany (3 Sep 1984).

The measured decay properties of $^{151}$Lu and $^{147}$Tm have been used as fix points in search experiments for further proton radioactive nuclei. The search has been extended for the lighter elements down to antimony (Z=51), and for the heavier elements up to bismuth (Z=83). Regions near closed shells (Z=50, 82, and N=82) have been taken into consideration as well as regions where strong nuclear deformations are expected. (orig.).

47742 (INIS-mf—9351, pp 196-202) **$^{145}$Eu mass from $^{144}$Sm($^{3}$He,d) and from an analysis of high spin states.** Rubio, B.; Julin, R.; Ercan, A.; Zuber, K.; Kleinheinz, P.; Tain, J.L.; Berg, G.P.A.; Hlawatsch, G.; Katayama, I.; Meissburger, J. (Kernforschungsanlage Juelich G.m.b.H., Germany, F.R.). 1984. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781594. (CONF-8409143—).

From 7. international conference on atomic masses and fundamental constants (AMCO-7); Darmstadt-Seeheim, F.R. Germany (3 Sep 1984).

A shell model decomposition of specific aligned multiparticle high spin states in $^{148}$Eu and $^{146}$Gd suggests a revision of the $^{145}$Eu mass. A measurement with the $^{144}$Sm($^{3}$He,d) reaction gave the mass excess M($^{145}$Eu) = - 77995(7) keV which differs by 59(17) keV from the 1977 tabulated value. In a $^{144}$Sm($^{3}$He,p) measurement the $^{146}$Eu mass excess was determined as M($^{146}$Eu) = -77119(13) in close agreement with the mass table. (orig.).

47743 (INIS-mf—9351, pp 203-209) **Atomic masses around $^{146}$Gd derived from decay properties.** Schrewe, U.J.; Tidemand-Petersson, P.; Dornhoefer, H.; Runte, E.; Schmidt-Ott, W.D.; Voth, E.; Behrens, H.; Michaelsen, R. (Goettingen Univ., Germany, F.R.). 1984. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781594. (CONF-8409143—).

From 7. international conference on atomic masses and fundamental constants (AMCO-7); Darmstadt-Seeheim, F.R. Germany (3 Sep 1984).

Atomic masses in a region around $^{146}$Gd were derived from partial decay constants of individual $\beta$-transitions resulting from $\gamma$-spectroscopic investigations. The $\beta$-decay energies were obtained by comparing experimental values of relative Psub(K)-ratios and EC/$\beta^+$ ratios with energy-dependent theoretical ratios. Decay-energy determinations for the nuclei sup(145,147)Eu, sup(147,149)Gd, sup(147g),sup(147m)Tb, sup(148g),sup(148m)Tb, sup(149m)Tb, $^{148}$Dy and sup(150m,152m)Ho are summarized. Based on this new mass information, systematic trends of the nucleon separation energies around $^{146}$Gd are discussed. In contrast to level structures of earlier studies, the mass data offer only weak evidence for a double magicity of $^{146}$Gd. (orig.).

47744 (INIS-mf—9351, pp 217-221) **Ground state mass of $^{147}$Gd from single-neutron transfer reactions.** Mann, L.G.; Decman, D.J.; Massey, T.N.; Struble, G.L.; Sisson, D.H.; Henderson, C.M.; Rubio, B.; Kleinheinz, P.; Tain, J.L.; Berg, G.P.A. (Lawrence Livermore National Lab., CA). 1984. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781594. (CONF-8409143—).

From 7. international conference on atomic masses and fundamental constants (AMCO-7); Darmstadt-Seeheim, F.R. Germany (3 Sep 1984).

We used thin targets of radioactive $^{148}$Gd to determine a precise value for the mass of $^{147}$Gd. The (p,d), (d,t) and ($^{3}$He,$\alpha$) reactions were used with high-resolution charged particle spectrometry to determine Q-values for the $^{148}$Gd target relative to several calibration targets having known Q-values. By combining the measured Q-value with the 1977 $^{148}$Gd mass we get the mass excess, M($^{147}$Gd) = -75356 +- 6 keV, which differs by proportional 150 keV from both the 1977 and 1983 mass tabulations but in opposite directions. (orig.).

47745 (INIS-mf—9351, pp 220-221) **Single proton states in $^{149}$Tb from the $^{148}$Gd(tau,d) reaction.** Decman, D.J.; Mann, L.G.; Massey, T.N.; Struble, G.L.; Sisson, D.H.; Henderson, C.M.; Scheerer, H.J.; Kleinheinz, P.; Thomas, K.E.; O'Brian, H.A. (Lawrence Livermore National Lab., CA). 1984. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781594. (CONF-8409143—).

From 7. international conference on atomic masses and fundamental constants (AMCO-7); Darmstadt-Seeheim, F.R. Germany (3 Sep 1984).

47746 (INIS-mf—9351, pp 222-228) **M4 isomer in $_{81}^{149}$Er$_{68}$ and the proton single particle states in $_{82}^{149}$Ho$_{67}$.** Schardt, D.; Larsson, P.O.; Kirchner, R.; Klepper, O.; Koslowsky, V.T.; Roeckl, E.; Rykaczewski, K.; Zuber, K.; Roy, N.; Kleinheinz, P. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt, Germany, F.R.). 1984. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781594. (CONF-8409143—).

From 7. international conference on atomic masses and fundamental constants (AMCO-7); Darmstadt-Seeheim, F.R. Germany (3 Sep 1984).

We have used the $^{93}$Nb($^{58}$Ni,pn) reaction to produce the N=81 nucleus $^{149}$Er and have studied its decay. Following mass separation on line we measured $\beta$-delayed protons as well as $\gamma$-rays emitted after $\beta$-decay. (orig./HSI).

47747 (INIS-mf—9351, pp 229-236) **Beta-delayed proton emission of dysprosium and erbium precursors.** Schardt, D.; Larsson, P.O.; Kirchner, R.; Klepper, O.; Koslowsky, V.T.; Roeckl, E.; Rykaczewski, K.; Kleinheinz, P.; Zuber, K. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt, Germany, F.R.). 1984. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781594. (CONF-8409143—).

From 7. international conference on atomic masses and fundamental constants (AMCO-7); Darmstadt-Seeheim, F.R. Germany (3 Sep 1984).

In this contribution we present a systematic study of $\beta$-delayed proton emission in the quadrant Z >= 64, N <= 82. The endpoint energies of the measured proton spectra represent upper limits of the corresponding Qsub(EC)-Ssub(p) values. From the ob-

served fine structure, level densities were deduced by means of a fluctuation analysis. (orig./HSI).

47748 (INIS-mf—9351, pp 237-243) **Beta-delayed proton activities: $^{147}$Dy and $^{149}$Er.** Toth, K.S.; Ellis-Akovali, Y.A.; Moltz, D.M.; Schloemer, E.C.; Cable, M.D.; Avignone, F.T. III. (Oak Ridge National Lab., TN). 1984. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781594. (CONF-8409143—).

From 7. international conference on atomic masses and fundamental constants (AMCO-7); Darmstadt-Seeheim, F.R. Germany (3 Sep 1984).

The present paper discusses mainly the $\beta$-delayed proton spectra of $^{147}$Dy and of the hitherto unknown isotope, $^{149}$Er. However, following the submittal of the abstract for this conference we have now observed delayed protons following the decay of $^{148}$Dy. Additionally, we have identified a 0.5-s delayed-proton emitter and tentatively assign it to the new isotope, $^{151}$Yb. (orig.).

47749 (INIS-mf—9351, pp 315-321) **Laserspectroscopy of indium and tin isotopes.** Eberz, J.; Huber, G.; Lochmann, H.; Menges, R.; Ulm, G. (Mainz Univ. (Germany, F.R.). Inst. fuer Physik); Kirchner, R.; Klepper, O.; Kuehl, T.; Larsson, P.O.; Marx, D. 1984. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781594. (CONF-8409143—).

From 7. international conference on atomic masses and fundamental constants (AMCO-7); Darmstadt-Seeheim, F.R. Germany (3 Sep 1984).

By means of laser spectroscopy the authors have determined the magnetic dipole moments and electric quadrupole moments of the isotopes $^{109-111}$In and $^{109-110}$Sn produced by fusion of 80-100 MeV $^{16}$O beams with enriched Mo targets. From the quadrupole moments the differential charge radii were derived. (HSI).

47750 (INIS-mf—9351, pp 334-340) **Isotopic variation of mean-square charge radius of europium nucleus measured by the resonant atomic photoionization method.** Alkhazov, G.D.; Borzakh, A.E.; Berlovich, E.Y.; Denisov, V.P.; Dernyatin, A.G.; Ivanov, V.S. (Leningrad Inst. of Nuclear Physics, Gatchina (USSR)); Fedoseev, V.N.; Letokhov, V.S.; Mishin, V.I.; Kompanets, O.N. (AN SSSR, Troitsk. Inst. Spektroskopii). 1984. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781594. (CONF-8409143—).

From 7. international conference on atomic masses and fundamental constants (AMCO-7); Darmstadt-Seeheim, F.R. Germany (3 Sep 1984).

We report on the on-line measurements of IS for $^{141-144}$Eu with Tsub(1/2) up to 10 s. (orig./HSI).

47751 (INIS-mf—9351, pp 341-346) **Nuclear moments and mean square charge radii of $^{140-153}$Eu.** Ahmad, S.A.; Klempt, W. (European Organization for Nuclear Research, Geneva (Switzerland)); Ekstroem, C. (Chalmers Tekniska Hoegskola, Goeteborg (Sweden)); Neugart, R.; Wendt, K. (Mainz Univ. (Germany, F.R.). Inst. fuer Physik). 1984. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781594. (CONF-8409143—).

From 7. international conference on atomic masses and fundamental constants (AMCO-7); Darmstadt-Seeheim, F.R. Germany (3 Sep 1984).

We report on our first measurements of the odd-Z element europium. The hfs and IS for 14 isotopes in the range $^{140-153}$Eu, have been determined in the two Eu I transitions at 4627 A ($4f^7\,6s^2$ $^8$Ssub(7/2) -> $4f^7\,6s6p$ $^8$Psub(7/2)) and 4594 A ($4f^7\,6s^2$ $^8$Ssub(7/2) -> $4f^7\,6s6p$ $^8$Psub(9/2)), using the method of collinear fast beam-laser spectroscopy at ISOLDE/CERN. (orig./HSI).

47752 (INIS-mf—9351, pp 612-618) **Axial-vector interaction constant for the $\beta^+$-decay of heavy nuclei.** Alkhazov, G.D.; Bykov, A.A.; Wittmann, V.D.; Moroz, F.V.; Orlov, S.Yu.; Starodubsky, V.E.; Tarasov, V.K. (Leningrad Inst. of Nuclear Physics, Gatchina (USSR)). 1984. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781594. (CONF-8409143—).

From 7. international conference on atomic masses and fundamental constants (AMCO-7); Darmstadt-Seeheim, F.R. Germany (3 Sep 1984).

Beta strength function of sup(147m,149,151)Dy have been obtained from total absorption spectra of $\gamma$-rays following $\beta$-decay. The strength functions have been calculated within the framework of selfconsistent HF+RPA theory with Skyrme interaction. The experimental and theoretical Ssub($\beta$) exhibit a pronounced narrow maximum which comprises the most part of the Gamow-Teller $\beta$-strength. The effective value of axial lepton-nucleon coupling constant has been estimated from the comparison of the experimental and theoretical results. (orig.).

47753 (INIS-mf—9759, pp 271) **Level structure of $^{124}$Te.** Hamilton, W.D.; Robinson, S.J.; Subber, A. (Sussex Univ., Brighton (UK). Physics Division); Schreckenbach, K. (Institut von Laue-Longevin, Grenoble (France)). 1984. NTIS (US Sales Only), PC A20/MF A01. File Number DE85781595. (CONF-8403127—).

From 5. Nordic meeting on nuclear physics; Jyvaskyla, Finland (12 Mar 1984).

Short note.

47754 (INIS-SU—301, pp 144-147) **Shape of a giant electric dipole resonance in the low energy region.** Vtyurin, V.A.; Popov, Yu.P.; Furman, V.I. (Joint Inst. for Nuclear Research, Dubna, USSR). 1984. (In Russian). NTIS (US Sales Only), PC A18/MF A01. File Number DE85781590. (CONF-8310228—Vol.1).

From 6. Soviet national conference on neutron physics; Kiev, USSR (10 Oct 1983).

A discrepance is observed of data on the $^{143}$Nd(n, $\gamma\alpha$) reaction at Esub($\gamma$) < 2 MeV with the Lorentz shape of the giant resonance. An expression is obtained which takes into account the dispersion characteristics of polarization operator and the temperature dependence of the giant resonance spreading over compound states. The expression describes well the experimental data. 13 references, 1 figure.

47755 (INIS-SU—301, pp 167-171) **Contribution of a direct one-step mechanism to the charge-exchange proton reaction with zirconium 90 at Esub(p) = 22.2 MeV.** Titarenko, N.N.; Yadrovskij, E.L. (Fiziko-Ehnergeticheskij Inst., Obninsk, USSR). 1984. (In Russian). NTIS (US Sales Only), PC A18/MF A01. File Number DE85781590. (CONF-8310228—Vol.1).

From 6. Soviet national conference on neutron physics; Kiev, USSR (10 Oct 1983).

The singlest direct emission in the $^{90}$Zr(p,n) reaction with 22.2 MeV protons are estimated by the microscopic DWBA method. Contribution of a direct one-step mechanism to complete spectrum of $^{90}$Zr(p, n) reaction neutrons for 22.2 MeV protons is estimated on the base of the microscopic method of distorted waves. The calculated cross sections of proton recharge reaction proceeding with excitation of $^{90}$Nb simple states neutron spectrum is shown to be explained mainly by contribution of direct one-step excitation of $^{90}$Nb states lying below isobar-analog $0^+$ state at E=5.14 MeV. 12 references, 1 figure, 1 table.

47756 (INIS-SU—301, pp 181-184) **Analysis of the hard part of the $^{90}$Zr(p,n) reaction neutron spectrum.** Titarenko, N.N.; Yadrovskij, E.L. (Fiziko-Ehnergeticheskij Inst., Obninsk, USSR). 1984. (In Russian). NTIS (US Sales Only), PC A18/MF A01. File Number DE85781590. (CONF-8310228—Vol.1).

From 6. Soviet national conference on neutron physics; Kiev, USSR (10 Oct 1983).

The $^{90}$Zr(p,n) cross section of the 22.2 MeV protons was calculated by the microscopical DWBA method. The Vertical bar 1gsub(9/2)sup(-1) (n)1gsub(9/2)(p): $I^+$ > state excitations of $^{90}$Nb were considered. The results of calculation were compared with the experiment. Calculations for the $O^+$ and $1^+$ states agree with experimental angular distributions and for the $2^+$ state the discrepancy between theory and experiment is observed. 19 references, 1 figures, 2 tables.

47757 (INIS-SU—301, pp 191-194) **Applicability of the independent channel approach for the calculation of particle emission from compound nuclei.** Ezhov, S.N.; Kabakova, N.E.; Plyujko, V.A. (Kievskij Gosudarstvennyj Univ., Ukrainian SSR). 1984. (In Russian). NTIS (US Sales Only), PC A18/MF A01. File Number DE85781590. (CONF-8310228—Vol.1).

From 6. Soviet national conference on neutron physics; Kiev, USSR (10 Oct 1983).

A possibility of using the method of independent channels for calculation of cross section fluctuations is exemplified by the $^{153}$Sm(n,n') reaction. Distributions of absolute values of S matrix elements and matrix of permeability calculated in the frames of the generalized optical model are given. It is shown that the method of independent channels can be applied in calculations of the fluctuation part of characteristics of nuclear reactions. 3 references.

47758 (INIS-SU—301, pp 199-203) **Method of determination of doorway state occupation probabilities in nuclear reactions.** Plyujko, V.A. (Kievskij Gosudarstvennyj Univ., Ukrainian SSR). 1984. (In Russian). NTIS (US Sales Only), PC A18/MF A01. File Number DE85781590. (CONF-8310228—Vol.1).

From 6. Soviet national conference on neutron physics; Kiev, USSR (10 Oct 1983).

Probabilities of doorway state occupation in nuclear reactions are determined within the frames of the exciton model. The exciton model is generalized for the case of the doorway state being superposition of particle-hole configurations. Spectrum of inelastic-scattered neutrons on $^{93}$Nb and cross section of the $^{93}$Nb(n, n') reaction are calculated. The doorway state is shown to be three-quasiparticle in inelastic neutron scattering on Nb.

47759 **(LBL—19806) Compound nucleus studies with reverse kinematics.** Moretto, L.G. (Lawrence Berkeley Lab., CA (USA)). Jun 1985. Contract AC03-76SF00098. 18p. (CONF-8505172—3). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85016630.

From Conference on nuclear structure with heavy ions; Legnaro, Padova, Italy (27 May 1985).

Reverse kinematics reactions are used to demonstrate the compound nucleus origin of intermediate mass particles at low energies and the extension of the same mechanism at higher energies. No evidence has appeared in our energy range for liquid-vapor equilibrium or cold fragmentation mechanisms. 11 refs., 12 figs.

## 6518 Nuclear Properties And Reactions, A=150-189, Theoretical

47760 (CONF-820942—41) **$^{187}$Os + n resonance parameters in the interval 27-500 eV neutron energies.** Winters, R.R.; Carlton, R.F.; Harvey, J.A.; Hill, N.W. (Denison Univ., Granville, OH (USA); Middle Tennessee State Univ., Murfreesboro (USA); Oak Ridge National Lab., TN (USA)). 1982. Contract AC05-84OR21400. 2p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85017079.

From Nuclear data for science and technology international conference; Antwerp, Belgium (6 Sep 1982).

The neutron total cross section for $^{187}$Os, in the energy range, 27 eV to 500 eV, has been measured at the ORELA facility by the neutron time-of-flight technique, utilizing a 2.0 gm osmium sample (n = 0.008401 Os-nuclei/barn) enriched to 70.38% $^{187}$Os. Measurements were performed at a 80 m flight station with an energy resolution, $\Delta E/E$, of 0.1% using a $^{6}$Li glass scintillator. Resolved resonances have been analyzed by a Reich-Moore multilevel code (SAMMY) to obtain parameters for 85 resonances up to 500 eV. Preliminary determinations of the level spacing (5 eV) and s-wave strength function ($3.9 \times 10^{-4}$) for $^{187}$Os are in agreement with recent analyses of the osmium isotopes, made in connection with the use of the Re/Os chronometer for estimating the duration of stellar nucleosynthesis.

47761 (GSI—85-10, pp 701-706) **Nuclear lattice model.** Bauer, W.; Dean, D.R.; Mosel, U.; Post, U. Mar 1985. B. File Number DE85752251. (CONF-8410210—).

From 7. high energy heavy ion study conference; Darmstadt, F.R. Germany (8 Oct 1984).

In an attempt to isolate the essential features of proton-induced multi-fragmentation reactions, a new, percolation-theory based model is introduced. After clarifying the underlying concepts, it is shown that this model can account for the essential characteristics of these reactions, such as the U-shape mass-yield distributions and the power-law dependence of the production cross section for low-to-medium mass fragments.

47762 (INIS-mf—9351, pp 251-256) **Isomeric states in neutron-deficient mercury and platinum isotopes.** Bourgeois, C.; Kilcher, P.; Roussiere, B.; Sauvage, J. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire); Porquet, M.G. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire; Paris-11 Univ., 91 - Orsay (France). Centre de Spectrometrie Nucleaire et de Spectrometrie de Masse); Macias-Marques, M.I. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire; Centro de Fisica de Fenomenos de Ionizacao, Lisbon (Portugal)); Wojtasiewicz, A. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire; Warsaw Univ. (Poland)). 1984. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781594. (CONF-8409143—).

From 7. international conference on atomic masses and fundamental constants (AMCO-7); Darmstadt-Seeheim, F.R. Germany (3 Sep 1984).

In the present paper we stress on the characteristics of the long-lived isomeric states we have established in $^{185}$Hg, $^{183}$Pt and $^{185}$Pt. A brief description of the experimental techniques are given and some interpretations are presented. (orig./HSI).

47763 (INIS-mf—9351, pp 257-263) **Qsub($\beta$) measurements of sup(184,188)Hg, sup(184,188)Au.** Dautet, H.; Campeau, N.; Lee, J.K.P. (McGill Univ., Montreal, Quebec (Canada). Foster Radiation Lab.); Bourgeois, C.; Roussiere, B. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire); Houdayer, A. (Montreal Univ., Quebec (Canada). Lab. de Physique Nucleaire). 1984. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781594. (CONF-8409143—).

From 7. international conference on atomic masses and fundamental constants (AMCO-7); Darmstadt-Seeheim, F.R. Germany (3 Sep 1984).

The experiments reported here were performed at the Institut de Physique Nucleaire, Orsay, France. Mass separated sources were obtained using the ISOCELE facility. (orig./HSI).

47764 (INIS-mf—9351, pp 265-271) **Decay properties of $^{186}$Pb and the lead alpha-decay rate anomaly.** Toth, K.S.; Ellis-Akovali, Y.A. (Oak Ridge National Lab., TN (USA)); Bingham, C.R. (Tennessee Univ., Knoxville (USA)); Moltz, D.M. (South Carolina Univ., Columbia (USA)); Carter, H.K.; Mlekodaj, R.L.; Spejewski, E.H. (UNISOR, Oak Ridge, TN (USA)); Sousa, D.C. (Eastern Kentucky Univ., Richmond (USA)). 1984. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781594. (CONF-8409143—).

From 7. international conference on atomic masses and fundamental constants (AMCO-7); Darmstadt-Seeheim, F.R. Germany (3 Sep 1984).

The authors have measured the alpha decay properties at $^{186}$Pb produced in the reaction $^{160}$Dy ($^{32}$S, Gn) at 200 MeV. (HSI).

47765 (INIS-mf—9351, pp 652-658) **Capture ratio N/M in the EC beta decay of $^{163}$Ho.** Laegsgaard, E.; Andersen, J.U.; Hansen, P.G. (Aarhus Univ. (Denmark). Inst. of Physics); Beyer, G.J. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)); Rujula, A. de; Jonson, B.; Ravn, H.L. (European Organization for Nuclear Research, Geneva (Switzerland)). 1984. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781594. (CONF-8409143—).

From 7. international conference on atomic masses and fundamental constants (AMCO-7); Darmstadt-Seeheim, F.R. Germany (3 Sep 1984).

We report the determination of the N/M capture ratio and the re-determination of Tsub(1/2)sup(M) by total-absorption spectrometry. (orig./HSI).

47766 (INIS-mf—9759, pp 45-81) **Discrete line and continuum γ-ray spectroscopy of rare earth nuclei.** Lisle, J.C. (Manchester Univ. (UK)). 1984. NTIS (US Sales Only), PC A20/MF A01. File Number DE85781595. (CONF-8403127—).

From 5. Nordic meeting on nuclear physics; Jyvaskyla, Finland (12 Mar 1984).

The properties of stably deformed rare earth nuclei are discussed. Moments of inertia are derived from discrete line and continuum γ-ray spectroscopic data and a rigid body type of rotational behaviour is observed. The implications of this phenomenon are discussed and tentative evidence for loss of neutron pairing is considered. The γ-ray decay modes of good rotors and transitional nuclei are compared. (author).

47767 (INIS-mf—9759, pp 83-97) **Nuclear structure effects in the Dy nuclei at high excitation and low spin.** Rekstad, J.; Guttormsen, M.; Ramsoey, T.; Ingebretsen, F. (Oslo Univ. (Norway). Inst. of Physics); Thorsteinsen, T.F.; Loevhoeiden, G.; Roedland, T. (Bergen Univ. (Norway). Inst. of Physics). 1984. NTIS (US Sales Only), PC A20/MF A01. File Number DE85781595. (CONF-8403127—).

From 5. Nordic meeting on nuclear physics; Jyvaskyla, Finland (12 Mar 1984).

By means of particle-γ coincidence measurements the decay modes for highly excited low spin states in some Dy isotopes have been investigated. We have studied couplings between two-quasiparticle states and vibration in the energy region from 1.5 to 2.5 MeV, non-statistical cooling in the energy region from 2.5 to 6.5 MeV, and the neutron emission from threshold up to approximately 40 MeV of excitation. (author).

47768 (INIS-mf—9759, pp 201-215) **Single-neutron states in odd-N ytterbium isotopes and the disappearence of neutron pair correlations.** Bacelar, J.C.; Diebel, M.; Ellegaard, C.; Garrett, J.D.; Hagemann, G.B.; Herskind, B.; Holm, A.; Yang, C.H. (Niels Bohr Inst., Copenhagen (Denmark)); Tjoem, P.O. (Oslo Univ. (Norway). Fysisk Inst.); Lisle, J.K. (Manchester Univ. (UK). Schuster Lab.). 1984. NTIS (US Sales Only), PC A20/MF A01. File Number DE85781595. (CONF-8403127—).

From 5. Nordic meeting on nuclear physics; Jyvaskyla, Finland (12 Mar 1984).

New high-spin data for $^{167}$Yb and $^{169}$Yb are presented. A systematic analysis of relative excitation energies of sigle-neutron states at large rotational frequencies in odd-N ytterbium isotopes from $^{161}$Yb to $^{169}$Yb is discussed. From this analysis evidence is given for the effective disappearence of neutron pair correlations. (author).

47769 (INIS-SU—301, pp 195-198) **Effect of direct processes on a fluctuation cross section.** Ezhov, S.N.; Kabakova, N.E.; Plyujko, V.A. (Kievskij Gosudarstvennyj Univ., Ukrainian SSR). 1984. (In Russian). NTIS (US Sales Only), PC A18/MF A01. File Number DE85781590. (CONF-8310228—Vol.1).

From 6. Soviet national conference on neutron physics; Kiev, USSR (10 Oct 1983).

Contribution of direct and compound nuclear processes at inelastic scattering of low-energy neutrons is investigated. The results of calculation of the reaction fluctuation cross section by means of unitary conversion (Engelbrecht-Weidenmuller) are presented. Functions of $0^+$ and $4^+$ excitation states for the $^{182}$W(n,n') reaction are given. Contribution of direct processes is shown to be negligible for inelastic scattering and it is shown to monotonously increase with growth of cross section. 9 references, 2 figures.

47770 (JINR—1-84-455) **Measurement of the yields of residual nuclei in interactions 17.9 GeV/c α-particles with sup(159)Tb, sup(181)Ta and sup(207,2)Pb nuclei.** Butsev, V.S.; Butseva, G.L.; Kostin, V.Ya.; Migalenya, V.Ya. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation). 1984. 12p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE85702112.

The results of investigations of 17.9 GeV/c α-particle interactions with Tb, Ta and Ph nuclei are presented. Measurements have been carried out of the relative yields of residual nuclei for the (α+Tb), (α+Ta) and (α+Pb) reactions in the 24 <= A <= 157, 24 <= A <= 178 and 24 <= A <= 204 mass range, respectively. For the isotopes $^{93}$Tc, $^{133}$Ce and $^{190}$Tl the isomeric ratios are determined, that are compared with the isomeric ratios measured in reactions induced by 500 MeV protons and by 25.2 GeV $^{12}$C ions.

47771 (JINR-R—6-84-556) **Study of the decay of oriented $^{173}$Lu nuclei.** Davaa, S.; Kratsikova, T.I.; Finger, M.; Kvasil, Ya.; Lebedev, N.A.; Pavlov, V.N.; Yushkevich, Yu.V. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems). 1984. 17p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE85702111.

The decay of $^{173}$Lu nuclei implanted into ferromagnetic Gd matrix was studied by the nucleus orientation method at low temperatures. The γ-ray angular distribution was measured using high resolution Ge(Li) detectors. The anisotropies of 12 γ-lines in $^{173}$Yb have been measured and their multipolarity mixing ratios have been dedUced. The energies and level structure of rotational bands in $^{173}$Yb, reduced E2- and M1-transition probabilities and E2/M1 mixing ratios have been calculated using a quasiparticle-phonon model including the Coriolis interaction. In general, good agreement has been obtained between the theoretical predictions and experimental results.

47772 **Equilibration of $^{176}$Lu/sup g,m/ during the s-process.** Norman, E.B.; Bertram, T.; Kellogg, S.E.; Gil, S.; Wong, P. (Nuclear Physics Laboratory, University of Washington). *Astrophysical Journal;* **291**: No. 2, 834-837(15 Apr 1985).

The effects of photoexcitation and positron annihilation-excitation of $^{176}$Lu/sup g/ to $^{176}$Lu/sup m/ have been investigated. It is found that as a result of these two processes alone, $^{176}$Lu/sup g/ and $^{176}$Lu/sup m/ are in thermal equilibrium at temperatures > or =3.5 x $10^8$ K. This implies that $^{176}$Lu is not a reliable s-process chronometer.

## 6519 Nuclear Properties And Reactions, A=190-219, Theoretical

47773 (CERN-EP—85-47) **Search for hypernuclei formation in anti p annihilation on heavy nuclei.** Berrada, M.; Bocquet, J.P.; Epherre, M.; Eriksson, G.; Johansson, T.; Julien, J.; Kilian, K.; Konijn, J.; Krogulski, T.; Maurel, M. (Nationaal Inst. voor Kernfysica en Hoge-Energiefysica (NIKHEF), Amsterdam (Netherlands); European Organization for Nuclear Research, Geneva (Switzerland); Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.); CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France); CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Physique Nucleaire; CEA Centre d'Etudes Nucleaires de Saclay, 91 - Gif-sur-Yvette (France). Dept. de Physique Nucleaire). 15 Apr 1985. 7p. (CONF-850152—13). NTIS (US Sales Only), PC A02/MF A01. File Number DE85901948.

From 3. LEAR workshop; Tignes-Savoie, France (19 Jan 1985).

The present status of the CERN experiment PS177 on hypernuclei and its programme for the near future are reported. The basic ideas behind the experiment are briefly described, with particular emphasis on what is new, from both the experimental and the theoretical point of view. Futher details of the experiment can be found in the Proceedings of the 1982 LEAR (Erice) Workshop.

The aim of the experiment is to search for heavy hypernuclei in order to measure their lifetime. 12 refs., 5 figs.

47774 (GSI—85-10, pp 67-80) **Collective flow of nuclear matter.** Ritter, H.G.; Doss, K.G.R.; Gustafsson, H.A.; Gutbrod, H.H.; Kolb, B.; Loehner, H.; Ludewigt, B.; Poskanzer, A.M.; Renner, T.; Warwick, A. Mar 1985. B. File Number DE85752251. (CONF-8410210—).

From 7. high energy heavy ion study conference; Darmstadt, F.R. Germany (8 Oct 1984).

The reactions Ca + Ca, Nb + Nb and Au + Au have been studied at different energies at the Bevalac using the Plastic Ball spectrometer. A global analysis of the events shows two nontrivial collective flow effects, the bounce-off of the projectile fragments and the side-splash of the intermediate rapidity fragments for the higher multiplicity events. The side-splash effect increases with increasing target-projectile mass and decreases with increasing energy. The asymmetric reaction 800 MeV per nucleon Ar + Pb measured with the streamer chamber leads to sidewards flow for semicentral collisions only.

47775 (GSI—85-10, pp 317-328) **High energy cosmic ray events of ultra-relativistic nucleus-nucleus collisions.** Burnett, T.H.; Dake, S.; Derricson, J.H.; Fountain, W.; Fuki, M.; Gregory, J.C.; Hayashi, T.; Hayashi, T.; Holynski, R.; Iwai, J. Mar 1985. B. File Number DE85752251. (CONF-8410210—).

From 7. high energy heavy ion study conference; Darmstadt, F.R. Germany (8 Oct 1984).

Japanese American Cooperative Emulsion Experiment (JACEE) has been measuring ultrarelativistic comic ray nucleus and sampling the events in the energy regions both 10 to 100 GeV/A and above TeV/A by balloon emulsion chamber since 1979. In this report main results obtained up to now will be described.

47776 (GSI—85-10, pp 687-700) **Production of medium mass fragments in intermediate energy reactions.** Jacak, B.V.; Westfall, G.D.; Fox, D.; Gelbke, G.K.; Harwood, L.H.; Lynch, W.G.; Scott, D.K.; Tsang, M.B.; Symons, T.J.M. Mar 1985. B. File Number DE85752251. (CONF-8410210—).

From 7. high energy heavy ion study conference; Darmstadt, F.R. Germany (8 Oct 1984).

We have measured single particle inclusive cross sections for fragments with 1 <= A <= 14 from 42, 92 and 137 MeV/nucleon Ar + Au and Ca reactions.

47777 (GSI—85-10, pp 719-726) **Does nuclear fragmentation explore the gas-liquid phase transition of nuclear matter.** Gross, D.H.E. Mar 1985. B. File Number DE85752251. (CONF-8410210—).

From 7. high energy heavy ion study conference; Darmstadt, F.R. Germany (8 Oct 1984).

The phase space of channels is calculated into which a nucleus may decay after being hit by a proton with Esub(p) > 10 GeV. Special care is given to the finite size of the system and to the Couloub interaction between the fragments. Both effects are shown to be of crucial and dominant importance. At a temperature of 4-5 MeV the target decays into many fragments simultaneously. The mass yields is reproduced by the model over the entire mass range. Monte Carlo simulations show that also the energy spectra may realistically be reproduced and the slope parameter (the apparent temperature) Tsub(app) is proportional2 times larger than the true temperature. This is due to considerable fluctuations in the number of fragments and in their mutual Coulomb-interaction. The gas-liquid phase transition in nuclear matter is dramatically modified by these finite size and strong Coulomb effects. Some general features of this transition are discussed.

47778 (INIS-mf—9351, pp 41-47) **Precise atomic mass determinations at the University of Manitoba.** Ellis, R.J.; Hall, B.J.; Barber, R.C.; Dyck, G.R.; Sharma, K.S.; Derenchuk, V.P.; Lander, C.A.; Duckworth, H.E. (Manitoba Univ., Winnipeg (Canada). Dept. of Physics). 1984. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781594. (CONF-8409143—).

From 7. international conference on atomic masses and fundamental constants (AMCO-7); Darmstadt-Seeheim, F.R. Germany (3 Sep 1984).

The 1.00 m radius "Manitoba II" high resolution mass spectrometer was used to measure 21 new mass doublets. Depending on the doublet spacings, the instrument was operated with a resolving power of up to 250,000 (at proportional 10% of peak height). The mass difference between two different ionic species is measured by some variation of the peak matching technique. (orig./HSI).

47779 (INIS-mf—9351, pp 272-278) **$\beta^+$/EC and $\alpha$ decay of neutron-deficient Bi nuclei, a versatile tool to study intruder states in the Z=82 region.** Coenen, E.; Deneffe, K.; Huyse, M.; Duppen, P. van (Leuven Univ. (Belgium). Inst. voor Kern- en Stralingsfysika). 1984. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781594. (CONF-8409143—).

From 7. international conference on atomic masses and fundamental constants (AMCO-7); Darmstadt-Seeheim, F.R. Germany (3 Sep 1984).

This contribution deals with intruder states in odd (Tl and Bi), as well as in even-even (Pb) as in odd-odd (Tl) mass nuclei, all studied in the $\beta^+$/EC or $\alpha$ decay of neutron-deficient Bi nuclei. It reports on the observation of extremely low-lying $0^+$ intruder states in the $^{192-200}$Pb nuclei. It expands the systematics of this excitation energies of the intruder states in the odd mass $^{191-199}$Bi and $^{187-191}$Tl isotopes, by combining the energies of the different branches from the $\alpha$ decay of the isomer and groundstate in Bi to the isomer and groundstate in Tl. (orig./HSI).

47780 (INIS-mf—9351, pp 347-352) **Changes of charge radii of neutron-deficient Au isotopes.** Bollen, G.; Kluge, H.J.; Kremmling, H.; Moore, R.B.; Schaaf, H.W.; Streib, J.; Wallmeroth, K. (Mainz Univ. (Germany, F.R.). Inst. fuer Physik). 1984. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781594. (CONF-8409143—).

From 7. international conference on atomic masses and fundamental constants (AMCO-7); Darmstadt-Seeheim, F.R. Germany (3 Sep 1984).

The measurements reported in this paper are a continuation of our efforts to determine nuclear ground state properties of short-lived isotopes in the Hg region. In this paper, we report on an extension of these measurements to the short-lived isotopes $^{190}$Au-$^{193}$Au performed at the on-line mass separator ISOLDE/CERN, Geneva. (orig./HSI).

47781 (INIS-mf—9351, pp 361-369) **Stable intrinsic octupole deformation reflected in the moments and charge radii of radium isotopes.** Ahmad, S.A.; Klempt, W.; Wendt, K. (European Organization for Nuclear Research, Geneva (Switzerland)); Ekstroem, C. (Chalmers Tekniska Hoegskola, Goeteborg (Sweden)); Neugart, R.; Otten, E.W. (Mainz Univ. (Germany, F.R.). Inst. fuer Physik). 1984. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781594. (CONF-8409143—).

From 7. international conference on atomic masses and fundamental constants (AMCO-7); Darmstadt-Seeheim, F.R. Germany (3 Sep 1984).

Our measurements on isotope shifts (IS) and hyperfine structures (hfs) in a long sequence of radium isotopes can serve as a further contribution for this discussion. The data yield the nuclear spins and nuclear moments for the odd-A radium isotopes. Furthermore, the changes of mean square charge radii have been determined. The experimental results give additional evidence for the occurence of stable octupole deformation in the neutron rich radium isotopes, strengthening the confidence in the theoretical predictions. (orig./HSI).

## 6520 Nuclear Properties And Reactions, A=220 And Above, Theoretical

*REFER ALSO TO CITATION(S) 46452, 47782*

47782 (DOE/ER/10344—5) **Neutron scattering studies in the actinide region. Progress report, July 2, 1984-July 30, 1985.** Beghian, L.E.; Kegel, G.H.R. (Lowell Univ., MA (USA). Radiation Lab.). Aug 1985. Contract AC02-79ER10344. 48p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85017166.

During the past year we have been engaged in the following research areas: (1) analysis of the measurements of excitation functions for $^{232}$Th neutron elastic scattering as well as inelastic scattering for the first two excited states at 49 and 162 keV from 0.9 to 2.5 MeV incident energy; (2) elastic and inelastic neutron scattering angular distribution measurements on $^{235}$U, $^{238}$U and $^{232}$Th at 550 keV; (3) neutron scattering angular distribution measurements on $^{235}$U, $^{238}$U and $^{232}$Th at 200 keV; (4) $^{235}$U (n,n'$\gamma$) measurements; (5) preparation of an iron-filter neutron time-of-flight spectrometer; (6) presentation of results of (n,n') studies on states above 680 keV in $^{238}$U in a collaborative effort with Dr. E.D. Arthur of Los Alamos National Laboratory; (7) theoretical neutron inelastic scattering cross section calculations for $^{232}$Th, $^{238}$U and $^{240\ 242\ 244}$Pu and (8) improvements to the accelerator operation. 25 refs., 14 figs.

47783 (GSI—85-10, pp 403-411) **0.9 A GeV $^{238}$U on $^{238}$U collisions in the LBL streamer chamber.** Fung, S.Y.; Beavis, D.; Gorn, W.; Keane, D.; Liu, Y.M.; Poe, R.T.; VanDalen, G.; Vient, M. Mar 1985. B. File Number DE85752251. (CONF-8410210—).

From 7. high energy heavy ion study conference; Darmstadt, F.R. Germany (8 Oct 1984).

We report charged particle exclusive data for high multiplicity U on U events. Our analyses are based on comparison with Cugnon's intranuclear cascade model, and the explosion-evaporation simulation of Fai and Randrup. The azimuthal structure of the observed events shows evidence of collective flow. The widely used flow angle methodology proves to be relatively insensitive to collective effects under the conditions of the present experiment. An isotropic pattern of ejectile emission is not reached at maximum multiplicity.

47784 (GSI—85-17(prepr.)) **Hard photons from co-operative effects in intermediate energy heavy ion collisions.** Shyam, R.; Knoll, J. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)). Apr 1985. 19p. B. File Number DE85752252.

The statistical model developed earlier to study the pion production in nuclear collisions at intermediate beam energies has been extended to describe the spectra of hard photons measured in similar experiments. In this model the co-operative action of several of the target and projectile nucleons in the particle production is considered. It is found that the model is able to provide a good description of the experimental data. Comparisons are made with the calculations performed within the same model for the pion spectra observed in the same experiment with similar energies. The mechanisms of the production of pions and hard photons appear to be similar. Taking into account properly the Bose-Einstein statistics for photons affects only the low energy parts of the photon spectra.

47785 (INIS-mf—9351, pp 368-371) **Consequences of the octupole instability of nuclei around Ra-Th.** Boening, K.; Sobiczewski, A.; Lojewski, Z.; Nerlo-Pomorska, B.; Pomorski, K. (Institute for Nuclear Studies, Warsaw, Poland). 1984. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781594. (CONF-8409143—).

From 7. international conference on atomic masses and fundamental constants (AMCO-7); Darmstadt-Seeheim, F.R. Germany (3 Sep 1984).

In the present paper, we study vibrations of an even-even nucleus in the two-dimensional, quadrupole and octupole deformation, space. The two degrees of freedom are coupled by the potential energy. Thus, the vibrations are the coupled quadrupole and octupole modes. The hamiltonian is diagonalized in two-dimensional harmonic oscillator basis. The energies and wave functions of the vibrational states as well as the electromagnetic transitions between them are studied. (orig./HSI).

47786 (INIS-mf—9351, pp 466-471) **Calculated masses and half-lives for nuclei in the region 100 <= Z <= 110.** Leander, G.A.; Moeller, P.; Nix, J.R.; Howard, W.M. (UNISOR, Oak Ridge, TN). 1984. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781594. (CONF-8409143—).

From 7. international conference on atomic masses and fundamental constants (AMCO-7); Darmstadt-Seeheim, F.R. Germany (3 Sep 1984).

We have calculated nuclear masses and the corresponding $\alpha$-decay energies Qsub($\alpha$) and $\alpha$ half-lives Tsub($\alpha$) by use of the folded-Yukawa macroscopic-microscopic model, for nuclei at the end of the peninsula of known elements. We have also calculated, by use of the modified oscillator model, fission half-lives for even-even nuclei with Z between 100 and 110. The results agree well with data in this region, but an interpretation of the experimental data requires further and extensive theoretical studies of odd particle effects. (orig.).

47787 (INIS-mf—9351, pp 279-283) **Radioactive decay of $^{223}$Ra by emission of $^{14}$C.** Gales, S.; Hourani, E.; Hussonnois, M.; Schapira, J.P.; Stab, L.; Vergnes, M. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). 1984. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781594. (CONF-8409143—).

From 7. international conference on atomic masses and fundamental constants (AMCO-7); Darmstadt-Seeheim, F.R. Germany (3 Sep 1984).

The authors describe the experimental observation of the decay of $^{223}$Ra by $^{14}$C emission. They present an obtained branching ratio of (5.5 +- 2.0) x $10^{-10}$. (HSI).

47788 (INIS-mf—9351, pp 284-290) **Shell-stabilized deformed isotopes Z >= 106 and N=153-157.** Armbruster, P.; Folger, H.; Hessberger, F.P.; Hofmann, S.; Keller, J.G.; Muenzenberg, G.; Poppensieker, K.; Reisdorf, W.; Schmidt, K.H.; Schoett, H.J. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)). 1984. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781594. (CONF-8409143—).

From 7. international conference on atomic masses and fundamental constants (AMCO-7); Darmstadt-Seeheim, F.R. Germany (3 Sep 1984).

The elements 107 and 109 were made via the reactions $^{209}$Bi($^{54}$Cr,n)$^{263}$107, and $^{209}$Bi($^{58}$Fe,n)$^{266}$109, respectively, and have been identified by the detection of $\alpha$ decays connecting them genetically to known isotopes. A nuclei with odd numbers of protons or neutrons are known to be additionally stabilized against spontaneous fission, the synthesis of the even elements 106 and 108 was believed to be more difficult. (orig.).

47789 (INIS-mf—9351, pp 619-625) **Investigation of the integral beta-spectra of $^{235}$U(nsub(th),f)- and $^{239}$Pu(nsub(th),f)-fission products.** Keyser, U.; Muennich, F. (Technische Univ. Braunschweig (Germany, F.R.). Inst. fuer Metallphysik und Nukleare Festkoerperphysik); Weikard, H. (Institut Max von Laue - Paul Langevin, 38 - Grenoble (France)). 1984. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781594. (CONF-8409143—).

From 7. international conference on atomic masses and fundamental constants (AMCO-7); Darmstadt-Seeheim, F.R. Germany (3 Sep 1984).

The integral $\beta^-$-spectra of $^{235}$U and $^{239}$Pu fission products have been measured up to 15 MeV with a plastic scintillator telescope at an external neutron guide tube at the ILL in Grenoble. The highly enriched targets (150 - 800 $\mu g/cm^{-2}$) were placed in a vacuum fission chamber at a distance of approximately 110 m from the reactor core, where the background is strongly reduced. The measured sum beta$^-$-spectra for $^{235}$U and $^{239}$Pu fission products will be compared for electron energies 1 <= $E_0$ <= 9.5 MeV (related statistical error: 0.03% <= epsilon <= 2%) with other experimental data and with recent theoretical calculations. (orig.).

47790 (INIS-SU—301, pp 127-130) **Correlations of experimental data on neutron cross sections.** Dorogov, V.I.; Chistyakov, V.P. (Moskovskij Inzhenerno-Fizicheskij Inst., Moscow, USSR). 1984. (In Russian). NTIS (US Sales Only), PC A18/MF A01. File Number DE85781590. (CONF-8310228—Vol.1).

From 6. Soviet national conference on neutron physics; Kiev, USSR (10 Oct 1983).

The problem of the calculation of correlation coefficients from experimental neutron cross-sections of different authors is discussed. The correlation coefficients for $^{235}U$ cross-section are calculated. 3 references, 2 tables.

47791 (IPNO-DRE—84-32) **Characteristics of violent collisions in Ar-induced reactions at intermediate energies.** Rivet, M.F.; Borderie, B. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire). 1984. 18p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85752039.

We report on two experiments performed with the Ganil facility using the 27 MeV/u Ar beam. The first one concerns an intermediate mass system, Ar + Ag. For the second one a heavier fissile system, Ar + U, was chosen. For Ar + Ag information about fusion requires the measurements of evaporation residues and fission. In the Ar + U reaction, most of the collisions lead to fission. The violence of the collision is therefore determined from the correlation angle of the coincidence fission fragments.

## 6530 Nuclear Theory

47792 (GSI—85-10) **7th high energy heavy ion study.** Bock, R.; Gutbrod, H.H.; Stock, R. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (Germany, F.R.)). Mar 1985. 850p. (CONF-8410210—). B. File Number DE85752251.

From 7. high energy heavy ion study conference; Darmstadt, F.R. Germany (8 Oct 1984).

These proceedings contain the articles presented at the named conference. They deal with relativistic heavy ion reactions, the expansion and condensation of nuclear matter, anomalon experiments, and multifragmentation and particle correlations in heavy ion reactions.

47793 (GSI—85-10, pp 5-24) **Pion production and the nuclear equation of state.** Harris, J.W.; Odyniec, G.; Pugh, H.G.; Schroeder, L.S.; Tincknell, M.L.; Bock, R.; Brockmann, R.; Sandoval, A.; Stock, R.; Stroebele, H. Mar 1985. B. File Number DE85752251. (CONF-8410210—).

From 7. high energy heavy ion study conference; Darmstadt, F.R. Germany (8 Oct 1984).

In this presentation the relationship between the nuclear equation of state and relativistic nucleus-nucleus collisions is discussed with an emphasis on how to extract the former. That high density state of the collision should exist is shown. One observable, namely the pion multiplicity, is shown to survive the succeeding stages of the collision process to provide information on the equation of state at high densities. The resulting equation of state is presented and discussed in the light of recent theoretical developments.

47794 (GSI—85-10, pp 45-65) **Quark matter transition in the baryon rich domain.** Chapline, G.F. Mar 1985. B. File Number DE85752251. (CONF-8410210—).

From 7. high energy heavy ion study conference; Darmstadt, F.R. Germany (8 Oct 1984).

The implications of nuclear matter equation of state measurements for a quark matter phase transition are discussed. The possibility of detecting such a phase transition by looking for changes in the pattern of collective flow associated with heavy ion collisions is pointed out.

47795 (GSI—85-10, pp 81-104) **Hydrodynamics news.** Buchwald, G.; Graebner, G.; Theis, J.; Barthel, D.; Rentzsch, T.; Greiner, W.; Maruhn, J.A.; Stoecker, H. Mar 1985. B. File Number DE85752251. (CONF-8410210—).

From 7. high energy heavy ion study conference; Darmstadt, F.R. Germany (8 Oct 1984).

The confirmation of collective flow by recent experimental data suggests a reexamination of the problem of how to deduce the equation of state of nuclear matter from experiment. We discuss problems with the parametrization, the dependence of the flow properties and temperatures on the equation of state, and possible additional complications induced by the presence of transport effects. In addition the recently discovered preferred 90° azimuthal nucleon emission is presented and compared to experiment.

47796 (GSI—85-10, pp 105-115) **Thermalization and stopping in nuclear collisions.** Stroebele, H.; Bock, R.; Brockmann, R.; Harris, J.W.; Sandoval, A.; Stock, R.; Renfordt, R.E.; Schall, D.; Bangert, D.; Rauch, W. Mar 1985. B. File Number DE85752251. (CONF-8410210—).

From 7. high energy heavy ion study conference; Darmstadt, F.R. Germany (8 Oct 1984).

In this contribution we describe ways to verify stopping in nucleus-nucleus collisions and we analyse various reaction channels at energies between 400 MeV/u and 4 GeV/u in terms of the corresponding variables.

47797 (GSI—85-10, pp 117-126) **Fluctuations of rapidity density in high-energy nuclear interactions.** Friedlander, E.M. Mar 1985. B. File Number DE85752251. (CONF-8410210—).

From 7. high energy heavy ion study conference; Darmstadt, F.R. Germany (8 Oct 1984).

Recent advances in QCD have made it plausible to expect that in collisions of very energetic hadrons a phase transition to a quark-gluon plasma (QGP) may occur. There appears to be a consensus on one of the necessary conditions for such a transition, viz. that the energy density epsilon in the system exceed some critical value epsilonsub(c).

47798 (GSI—85-10, pp 127-140) **Nuclear stopping power.** Csernai, L.P. Mar 1985. B. File Number DE85752251. (CONF-8410210—).

From 7. high energy heavy ion study conference; Darmstadt, F.R. Germany (8 Oct 1984).

Proton-nucleus reactions are discussed in the framework of a multiple collision model. The longitudinal momentum distribution of baryons and the mean meson multiplicities and rapidity distributions are calculated and compared with the data. A momentum degradation length of 5.7 to 6.9 fm is found. These results are contrasted with other recent theoretical analyses.

47799 (GSI—85-10, pp 197-235) **Microscopic analysis of macroscopic effects in relativistic heavy ion collisions - towards the nuclear matter equation of state.** Molitoris, J.J.; Stoecker, H. Mar 1985. B. File Number DE85752251. (CONF-8410210—).

From 7. high energy heavy ion study conference; Darmstadt, F.R. Germany (8 Oct 1984).

Recent high multiplicity selected $4\pi$ data on collective flow and pion production from the GSI-LBL Plastic Ball and Streamer Chamber collaborations have yielded qualitatively new results which could not be understood on the basis of microscopic simulations such as the intranuclear cascade model. We present evidence that this is due to the neglect of the repulsive many body interactions in the dense nuclear medium. Results of a variety of microscopic calculations which include a nuclear matter equation of state (the classical equation of motion simulations, the Vlasov Uehling-Uhlenbeck theory, and the time dependent Dirac equation with meson field dynamics as well as the macroscopic nuclear fluid dynamical model) as well as their sensitivity to the equation of state are discussed. Evidence for a rather stiff nuclear matter equation of state is presented. We also look at the possibility of extracting the equation of state from measured light fragment production. As an outlook we discuss the next generation of experiments at higher energies, the possibility of forming quark matter at high baryon number densities and some of the recent suggestions on how to observe the phase transition experimentally. It is pointed out that - if the nuclear stopping observed at BEVALAC energies persists up to energies of 10 GeV/N - a deconfined baryon rich quark gluon plasma might be formed at the facilities presently under construction at Brookhaven and CERN.

47800 (GSI—85-10, pp 237-252) **Van der Waals approach: A consistent microscopic kinetic equation for relativistic heavy ion collisions.** Malfliet, R. Mar 1985. B. File Number DE85752251. (CONF-8410210—).

From 7. high energy heavy ion study conference; Darmstadt, F.R. Germany (8 Oct 1984).

As emphasized first by van der Waals the repulsive and attractive parts of the interparticle interaction in liquids play different roles. A careful treatment of both terms leads to a simple and transparent description of liquid properties. We review the present situation for the equilibrium observables like the equation of state where we focus on the dominant role of the repulsive part. We apply these ideas to the non-equilibrium situation and derive a kinetic equation which in the dilute limit corresponds to the Boltzmann equation. For more dense systems it corresponds to the Enskog equation with an appropriate mean field. This kinetic equation is then applied to relativistic heavy-ion reactions. Its effects are studied for situations where the density becomes appreciable with special attention for the phenomenon of collective flow.

47801 (GSI—85-10, pp 253-274) **Intranuclear cascade news.** Cugnon, J.; L'Hote, D. Mar 1985. B. File Number DE85752251. (CONF-8410210—).

From 7. high energy heavy ion study conference; Darmstadt, F.R. Germany (8 Oct 1984).

We emphasize the main contributions of the INC model to the general understanding of the relativistic heavy ion collisions, especially the quantitative description of off-equilibrium features of the collision process. The importance of two parameters which are expected to control the main off-equilibrium effects is underlined. We point out the possibility of observing in some systems, features of the bulk dynamics, i.e. the dynamics where the off-equilibrium effects are vanishing. We analyse recent data, which indicate that the entropy in high multiplicity events is dominated by the bulk dynamics. Intranuclear cascade calculations of the collective flow are discussed. They seem to be sensitive to the detail of the cascade models. We discuss the relationship between the observed flow and the intrinsic flow, which corresponds to all the particles. This relationship is strongly influenced by the Jacobian effect and the efficiency of the detector. The intrinsic flow angle seems to be sensitive to off-equilibrium effects. The role of the fluctuations is discussed.

47802 (GSI—85-10, pp 275-295) **Strange particle production in heavy ion collisions at Bevalac and Dubna energies.** Schuermann, B.; Zwermann, W. Mar 1985. B. File Number DE85752251. (CONF-8410210—).

From 7. high energy heavy ion study conference; Darmstadt, F.R. Germany (8 Oct 1984).

We discuss strange particle production in nucleus nucleus collisions at incident energies per nucleon of 2 to 4 GeV. In our comparison with the experimental data we concentrate on cascade model calculations. It is shown that the various cascade models all yield qualitatively similar results. The large $K^+$ transverse momenta observed cannot be explained. Whether this is due to a genuine physical effect not yet understood or merely a consequence of the oversimplified treatment of the scattering of the produced $K^+$ on the surrounding baryonic medium, remains at present an open question. For $K^-$ production, as well as for $\Lambda$ production at Dubna energies, the agreement with the experimental data is in general better. We point out the necessity for future experimental and theoretical efforts to clarify the picture of strange particle production.

47803 (GSI—85-10, pp 297-315) **Phase transitions in nuclear matter.** Glendenning, N.K. Mar 1985. B. File Number DE85752251. (CONF-8410210—).

From 7. high energy heavy ion study conference; Darmstadt, F.R. Germany (8 Oct 1984).

The rather general circumstances under which a phase transition in hadronic matter at finite temperature to an abnormal phase in which baryon effective masses become small and in which copious baryon-antibaryon pairs appear is emphasized. A preview is also given of a soliton model of dense matter, in which at a density of about seven times nuclear density, matter ceases to be a color insulator and becomes increasingly color conducting.

47804 (GSI—85-10, pp 453-459) **Introduction to the session on expansion and condensation.** Kapusta, J. Mar 1985. B. File Number DE85752251. (CONF-8410210—).

From 7. high energy heavy ion study conference; Darmstadt, F.R. Germany (8 Oct 1984).

The main goal for colliding heavy nuclei at high energy is to obtain information on the equation of state of hot, dense nuclear matter. The entropy may also provide information on the hottest and densest stage of the collision. There ought to be a one-to-one correspondence between the production of clusters and entropy since, after all, entropy is just a measure of the degree of orderedness of the system. However, many questions need yet to be answered. How is the entropy to be inferred from the cluster size distribution. What happens when the expanding nuclear matter encounters the boundary separating the liquid and gas phases. Is there phase separation. Is there supercooling or superheating. Where does the system pass out of thermal (kinetic) equilibrium. These are some of the questions to be addressed.

47805 (GSI—85-10, pp 461-476) **TDHF expansion dynamics.** Das Gupta, S. Mar 1985. B. File Number DE85752251. (CONF-8410210—).

From 7. high energy heavy ion study conference; Darmstadt, F.R. Germany (8 Oct 1984).

One can study the expansion phase in the TDHF (Time Dependent Hartree Fock) approximation. The scenario sketched above is based on nuclear matter ideas. In practice the compressed zone is finite and the surface will play a role. We will subject $^{16}O$ and $^{90}Zr$ to various initial compressions and subsequently follow the time evolution in the TDHF approximation.

47806 (GSI—85-10, pp 495-514) **Condensation of the fireball.** Boal, D.H. Mar 1985. B. File Number DE85752251. (CONF-8410210—).

From 7. high energy heavy ion study conference; Darmstadt, F.R. Germany (8 Oct 1984).

In this lecture, attention is focussed on the last stage of the evolution of the nuclear fireball: freeze-out.

47807 (GSI—85-10, pp 515-530) **Nuclear liquid-gas phase transition: Nucleation, fragmentation and density fluctuations.** Goodman, A.L. Mar 1985. B. File Number DE85752251. (CONF-8410210—).

From 7. high energy heavy ion study conference; Darmstadt, F.R. Germany (8 Oct 1984).

Sect.2 gives a simple derivation of the equation of state for nuclear matter. The existence of a critical point is established. The resulting liquid-gas phase transition is described. Although the phase transition is expected for nuclear matter, does it actually occur in heavy ion reactions. We consider two different scenarios. Sect.3 describes the transition from a supersaturated vapor to a liquid. The experimental signature for droplet formation is derived. Sect.4 considers the process of fragmentation in which a mechanically unstable phase breaks up into coexisting liquid and vapor phases. Phase transitions occur for infinite systems. For a finite nucleus, is the phase transition washed out. This question iss addressed in Sect.5, which considers statistical density fluctuations. In finite systems, these fluctuations can be important, even for states which are far from the critical point. It is shown that the density fluctuations wash out the phase transition for temperatures in the vicinity of the critical temperature, and they transport the system into the metastable and unstable regions of the phase diagram.

47808 (GSI—85-10, pp 531-535) **Possible solution to the entropy puzzle.** Csernai, L.P. Mar 1985. B. File Number DE85752251. (CONF-8410210—).

From 7. high energy heavy ion study conference; Darmstadt, F.R. Germany (8 Oct 1984).

The dynamics of the first order liquid-gas phase transition in the final expansion stage of a high energy heavy ion collision is studied. The high entropy values extracted from light particle abundances measured at low bombarding energies, Esub(Lab) = 50 - 300 A MeV, are explained as a consequence of the liquid-gas phase coexistence at the break-up of the nuclear matter.

47809 (GSI—85-10, pp 671-684) **Anomalons and multi-quark compound resonances.** Kim, Y.E.; Orlowski, M. Mar 1985. B. File Number DE85752251. (CONF-8410210—).

From 7. high energy heavy ion study conference; Darmstadt, F.R. Germany (8 Oct 1984).

Based on the resonating group quark-cluster model of nuclei, the anomalously short mean free paths observed in relativistic heavy-ion collisions are interpreted in terms of the enhancement of nuclear interaction cross-sections due to collective excitations of multi-quark compound resonances. Our model provides a consistent interpretation for controversial results of the recent anomalon experiments.

47810 (GSI—85-10, pp 741-752) **Expansion dynamics.** Knoll, J. Mar 1985. B. File Number DE85752251. (CONF-8410210—).

From 7. high energy heavy ion study conference; Darmstadt, F.R. Germany (8 Oct 1984).

A quantum dynamical model is suggested which describes the expansion and disassembly phase of highly excited compounds formed in energetic heavy-ion collisions. First applications in two space and one time dimensional model world are discussed and qualitatively compared to standard freeze-out concepts.

47811 (GSI—85-10, pp 763-770) **Coherent meson production in heavy ion collisions and Δ matter.** Fowler, G.N.; Weiner, R.M. Mar 1985. B. File Number DE85752251. (CONF-8410210—).

From 7. high energy heavy ion study conference; Darmstadt, F.R. Germany (8 Oct 1984).

The directional coherence recently observed in heavy ion collisions is attributed to coherent decay of a Δ matter state. Fluctuations in PI meson multiplicity in narrow rapidity bins proportional to $N^3$ where N is the number of participants are predicted. The fluctuations should display more a Poisson-like multiplicity distribution than events as a whole.

47812 (INIS-mf—9351, pp 399-405) **Nuclear shell structure based on QCD.** Bleuler, K. (Bonn Univ., Germany, F.R.). 1984. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781594. (CONF-8409143—).

From 7. international conference on atomic masses and fundamental constants (AMCO-7); Darmstadt-Seeheim, F.R. Germany (3 Sep 1984).

In this contribution I report on our work which relates nuclear structure (in particular shell structure) to the general principles of present day gauge theory. (orig./HSI).

47813 (INIS-mf—9351, pp 413-419) **Comprehensive and critical review of the predictive properties of the various mass models.** Haustein, P.E. (Brookhaven National Lab., Upton, NY). 1984. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781594. (CONF-8409143—).

From 7. international conference on atomic masses and fundamental constants (AMCO-7); Darmstadt-Seeheim, F.R. Germany (3 Sep 1984).

Since the publication of the 1975 Mass Predictions approximately 300 new atomic masses have been reported. These data come from a variety of experimental studies using diverse techniques and they span a mass range from the lightest isotopes to the very heaviest. It is instructive to compare these data with the 1975 predictions and several others (Moeller and Nix, Monahan and Serduke, Uno and Yamada) which appeared later. Extensive numerical and graphical analyses have been performed to examine the quality of the mass predictions from the various models and to identify features in these models that require correction. In general, there is only rough correlation between the ability of a particular model reproduce the measured mass surface which had been used to refine its adjustable parameters and that model's ability to predict correctly new masses. For some models distinct systematic features appear when the new mass data are plotted as functions of relevant physical variables. Global intercomparisons of all the models are made first, followed by several examples of types of analysis performed with individual mass models. (orig.).

47814 (INIS-mf—9351, pp 420-427) **Properties of mass equations based on mass relations and connections with other mass models.** Jaenecke, J. (Michigan Univ., Ann Arbor). 1984. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781594. (CONF-8409143—).

From 7. international conference on atomic masses and fundamental constants (AMCO-7); Darmstadt-Seeheim, F.R. Germany (3 Sep 1984).

Mass relations and the associated mass equations are powerful tools to describe and predict nuclear masses. They can be applied recursively. Many mass relations may also be viewed as partial difference equations which have solutions representing multi-parameter mass equations. Finding such solutions is a mathematical technique. The physical content is contained in the structure of the relation and implicitly in the data which are used as initial or boundary condition. (orig.).

47815 (INIS-mf—9351, pp 429-435) **Mass formula with few free parameters.** Johansson, S.A.E.; Spanier, L. (Lund Inst. of Tech., Sweden). 1984. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781594. (CONF-8409143—).

From 7. international conference on atomic masses and fundamental constants (AMCO-7); Darmstadt-Seeheim, F.R. Germany (3 Sep 1984).

In the present work we revise the formula of Johansson (1962) and Wene. This formula has the advantage of having a very small number of free parameters. Futhermore, the deformation is a variable and not only the deformation energy but also the shell correction is related to the deformation. This means that if the deformation is not known experimentally it has to be calculated or estimated in some way. Although this is a complication it has the great advantage of leading to a quite simple formula which gives masses in good agreement with experiment. (orig./HSI).

47816 (INIS-mf—9351, pp 436-442) **Many body theory based new mass relation for finite nuclei.** Satpathy, L.; Nayak, R. (Institute of Physics, Bhubaneswar, India). 1984. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781594. (CONF-8409143—).

From 7. international conference on atomic masses and fundamental constants (AMCO-7); Darmstadt-Seeheim, F.R. Germany (3 Sep 1984).

There are two main features of nuclear dynamics namely the shell feature and the liquid drop feature. Though depending upon the neutron and proton number one feature gets more manifested than the other especially in the ground state, still in general one can say that both features are equally important, one is not perturbation over the other. At a fundamental level these two features have the same origin in the many-body nature of the interacting Fermi system. Thus ideally, a successful mass formula or mass relation should have many-body theory as its basis. Recently we have made such an attempt. (orig.).

47817 (INIS-mf—9351, pp 443-449) **Nuclear mass formula and the quartet model.** Uno, M.; Sugaya, R.; Yamada, M. (Waseda Univ., Tokyo, Japan). 1984. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781594. (CONF-8409143—).

From 7. international conference on atomic masses and fundamental constants (AMCO-7); Darmstadt-Seeheim, F.R. Germany (3 Sep 1984).

We propose a mass formula constructed on an asymmetric quartet model of atomic nuclei. We modify the quartet model of Danos, Gillet et al. (1972), which is based on the SU(4) symmetry, by paying attention to the contribution from the kinetic energy of nucleons. We also take account of the differences among the bond-strengths of nucleon pairs in various states. The parameter values are determined by use of a statistical method. Main characteristics of the formula obtained are presented. (orig./HSI).

47818 (INIS-mf—9351, pp 450-456) **Partly frozen liquid-drop model of atomic nuclei.** Yamada, M.; Tominaga, T. (Waseda Univ., Tokyo, Japan). 1984. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781594. (CONF-8409143—).

From 7. international conference on atomic masses and fundamental constants (AMCO-7); Darmstadt-Seeheim, F.R. Germany (3 Sep 1984).

We propose a macroscopic nuclear model which consists of a core surrounded by a liquid. The core is elastic, and spherical in its equilibrium, and its motion is mainly responsible for high-energy phenomena such as giant resonances, while the motion of the liquid is mainly responsible for low-energy phenomena such as surface vibrations and rotations. A new feature of this model is that nuclear matter can freeze or melt at the surface of the core changing the core size. This implies that the concept of the core in this model is different from the one in the shell model; in our model we can change the core size continuously, unrestrained by shell closure. In the following we use this model to study low-energy properties of even-even nuclei such as ground-state masses, quadrupole and hexadecapole deformations, excitation energies of the lowest $2^+$ and $0^+$ excited states and E2 transition strengths. (orig./HSI).

47819 (INIS-mf—9351, pp 457-465) **Finite range droplet model.** Moeller, P.; Myers, W.D.; Swiatecki, W.J.; Treiner, J. (California Univ., Berkeley). 1984. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781594. (CONF-8409143—).

From 7. international conference on atomic masses and fundamental constants (AMCO-7); Darmstadt-Seeheim, F.R. Germany (3 Sep 1984).

A treatment of nuclear masses and deformations is described which combines the droplet model with the folding model surface and Coulomb energy integrals. An additional exponential term, inspired by the folding model, but treated here as an independent contribution with two adjustable parameters, is included. With this term incorporated, the accuracy of the predicted masses and fission barriers was improved significantly, the ability of the droplet model to account for isotope shifts in charge radii was retained, and the tendency of the droplet model to overpredict the surface-tension squeezing of light nuclei was rectified. (orig.).

47820 (INIS-mf—9351, pp 472-478) **Surface-symmetry and other static properties in the droplet and Hartree-Fock models.** Tondeur, F.; Berdichevsky, D. (Universite Libre de Bruxelles, Belgium). 1984. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781594. (CONF-8409143—).

From 7. international conference on atomic masses and fundamental constants (AMCO-7); Darmstadt-Seeheim, F.R. Germany (3 Sep 1984).

After a description of the droplet model the authors discuss the calculation of static nuclear properties by the Hartree-Fock method. Especially they consider the asymmetry term of the nuclear binding energy in the Hartree-Fock framework. Finally they discuss a unified Hartree-Fock description of all nuclear static properties. (HSI).

47821 (INIS-mf—9351, pp 479-486) **Semi-empirical description of low energy collective states in spherical nuclei.** Lombard, R.J.; Mas, D. (Paris-11 Univ., Orsay, France). 1984. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781594. (CONF-8409143—).

From 7. international conference on atomic masses and fundamental constants (AMCO-7); Darmstadt-Seeheim, F.R. Germany (3 Sep 1984).

Accurate calculations of nuclear ground state properties, in a microscopic way, require to go beyond Hartree-Fock, or Hartree-Fock-BCS, approximations. This can be achieved for instance, by introducing ground state correlations. In this respect, the RPA should provide us with a convenient tool, eventually successful, but it may be extremely tedious to perform a self-consistent program containing ground state correlations to start with. Consequently, we are studying the possibility of developing a step-wise method, trying to include the ground state correlations in a perturbative way, iterating the procedure if necessary. (orig.).

47822 (INIS-mf—9351, pp 487-495) **Extrapolation from measured nuclear properties to unmeasured quantities.** Friedrich, J.; Reinhard, P.G.; Voegler, N. (Mainz Univ., Germany, F.R.). 1984. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781594. (CONF-8409143—).

From 7. international conference on atomic masses and fundamental constants (AMCO-7); Darmstadt-Seeheim, F.R. Germany (3 Sep 1984).

By the least squares technique, we determine the free parameters of the phenomenological droplet model and those of the effective Skyrme force by a comparison to measured binding energies and radii. In the latter case, we also account for the surface width and the giant dipole resonance energy. The $chi^2$-minimizing technique yields best-fit parameter values and also the full error matrix with which uncertainties in extrapolations to other quantities can be estimated. We give best-fit parameter-sets and extrapolations to super-heavy nuclei and to nuclear matter. (orig.).

47823 (INIS-mf—9351, pp 503-507) **Developments in the Gross theory of masses.** Feix, W.F.; Hilf, E.R.; Wendel, M. (Technische Hochschule Darmstadt, Germany, F.R.). 1984. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781594. (CONF-8409143—).

From 7. international conference on atomic masses and fundamental constants (AMCO-7); Darmstadt-Seeheim, F.R. Germany (3 Sep 1984).

The purpose of the present paper is to study the effects of pairing correlations, calculated from wellknown concepts of superfluid nuclei, within the Gross theory of masses. (orig./HSI).

47824 (INIS-mf—9351, pp 508-515) **New mass relations and two- and four-nucleon correlations.** Jensen, A.S.; Hansen, P.G.; Jonson, B.; Vogel, P. (Aarhus Univ., Denmark). 1984. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781594. (CONF-8409143—).

From 7. international conference on atomic masses and fundamental constants (AMCO-7); Darmstadt-Seeheim, F.R. Germany (3 Sep 1984).

The authors analyze the evidence for two- and four-nucleon correlations in the experimentally determined nuclear masses. Then they present a binding energy term dependent on the parity of the unpaired nucleon states. (HSI).

47825 (INIS-mf—9351, pp 516-522) **Unified description of shape coexistence in nuclei: Implications for ground state properties.** Wood, J.L. (Georgia Inst. of Tech., Atlanta). 1984. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781594. (CONF-8409143—).

From 7. international conference on atomic masses and fundamental constants (AMCO-7); Darmstadt-Seeheim, F.R. Germany (3 Sep 1984).

The author discusses the contribution of proton intruder states to the nuclear ground state which leads to a nuclear deformation. The discussion is based on the residual pairing force between nucleons and the residual proton-neutron force. (HSI).

47826 (INIS-mf—9351, pp 523-529) **Do mass defects arise from core-coupled states.** Meyer, R.A.; Sistemich, K. (Lawrence Livermore National Lab., CA). 1984. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781594. (CONF-8409143—).

From 7. international conference on atomic masses and fundamental constants (AMCO-7); Darmstadt-Seeheim, F.R. Germany (3 Sep 1984).

We present evidence which suggests that for certain neutron-rich transitional nuclei at A about 100, the observed ground state may occur at an energy lower than expected from simple estimates. Two cases are considered. In one case, deformed configurations based on the intruder [404 9/2] orbital coexist in nominally vibrational nuclei and may cause a lowering of the ground state energy in odd-odd nuclei. In the other we point to (J-2) bands that seem to form the ground state of certain N = 59 isotones. (orig.).

47827 (INIS-mf—9351, pp 544-550) **Ambiguities in the characterisation of ground states of deformed odd-odd nuclei.** Sood, P.C. (Banaras Hindu Univ., Varanasi, India). 1984. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781594. (CONF-8409143—).

From 7. international conference on atomic masses and fundamental constants (AMCO-7); Darmstadt-Seeheim, F.R. Germany (3 Sep 1984).

The author presents a formulation for the contribution of the residual proton-neutron interaction to the binding energy of odd-odd nuclei, which is related to the splitting energy of the isospin triplet and singlet states. (HSI).

47828 (INIS-mf—9351, pp 592-598) **Experimental confirmation of the partially conserved axial current hypothesis in atomic nuclei.** Artamov, S.A.; Isakov, V.I.; Mezilev, K.A.; Novikov, Yu.N. (Leningrad Inst. of Nuclear Physics, Gatchina, USSR). 1984. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781594. (CONF-8409143—).

From 7. international conference on atomic masses and fundamental constants (AMCO-7); Darmstadt-Seeheim, F.R. Germany (3 Sep 1984).

The experimental confirmation of the PCAC hypothesis in atomic nuclei has been received from the analysis of the values both of the axial-vector weak current (Gsub(A)) and of the strong $\pi$N interaction (Gsub($\pi$NN)) effective constants in nuclei derived from the different in character experiments. (orig.).

47829 (INIS-mf—9351, pp 406-412) **EMC-effect: quarks, gluons and nuclear structure.** Rith, K. (Freiburg Univ., Germany, F.R.). 1984. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781594. (CONF-8409143—).

From 7. international conference on atomic masses and fundamental constants (AMCO-7); Darmstadt-Seeheim, F.R. Germany (3 Sep 1984).

The author discusses the effect of the nuclear structure on the structure function in deep inelastic muon scattering. (HSI).

47830 (INIS-mf—9351, pp 605-611) **Mirror beta decays in the fsub(7/2) shell.** Honkanen, J.; Aeystoe, J.; Koponen, V.; Taskinen, P.; Hyvoenen, H.; Aerje, J.; Vierinen, K.; Hautojaervi, A.; Eskola, K.; Miyatake, H. (Jyvaeskylae Univ., Finland). 1984. NTIS (US Sales Only), PC A99/MF A01. File Number DE85781594. (CONF-8409143—).

From 7. international conference on atomic masses and fundamental constants (AMCO-7); Darmstadt-Seeheim, F.R. Germany (3 Sep 1984).

With the aid of a reliable calculation it is possible to examine whether the axial vector coupling constant gsub(A) needs to be renormalized in complex nuclei as compared with the decay of the free neutron. In this work a systematic analysis is extended to the mirror nuclei in the fsub(7/2) shell. (orig./HSI).

47831 (INIS-mf—9759, pp 99-118) **MONSTER solves nuclear structure problems at low and high spins.** Hammaren, E.; Schmid, K.W.; Gruemmer, F. (Tuebingen Univ., Germany, F.R.). 1984. NTIS (US Sales Only), PC A20/MF A01. File Number DE85781595. (CONF-8403127—).

From 5. Nordic meeting on nuclear physics; Jyvaskyla, Finland (12 Mar 1984).

A microscopic, particle-number and spin conserving nuclear structure model is discussed. Within a unique theory the model can describe excitation energies, moments, transitions and spectroscopic factors at low and high spins of odd-mass and doubly-even nuclei in all mass regions. With a realistic two-body Hamiltonian extracted via a G-matric description from nucleon-nucleon scattering data. The model is here applied to nuclei in the A=130 region.

47832 (INIS-mf—9759, pp 245-262) **What can the nuclear high-spin properties tell us about the decrease of the pair-correlation energy.** Diebel, M. (Niels Bohr Inst., Copenhagen, Denmark). 1984. NTIS (US Sales Only), PC A20/MF A01. File Number DE85781595. (CONF-8403127—).

From 5. Nordic meeting on nuclear physics; Jyvaskyla, Finland (12 Mar 1984).

Pair-correlation energies at high spins are studied in cranking-HFB calculations under several model assumptions. The results are compared with experimental high-spin data: a) yrastlines of even-even nuclei b) systematics of rotational bands of odd-N nuclei and c) routhians of odd-N nuclei relative to corresponding routhians of neighbouring even-N isotopes. (author).

47833 (INIS-SU—301, pp 101-105) **Accuracy of the estimation of resonant self-shielding effects in the region of unresolved resonances.** Koshcheev, V.N.; Manturov, G.N.; Nikolaev, M.N.; Sinitsa, V.V. (Fiziko-Ehnergeticheskij Inst., Obninsk, USSR). 1984. (In Russian). NTIS (US Sales Only), PC A18/MF A01. File Number DE85781590. (CONF-8310228—Vol.1).

From 6. Soviet national conference on neutron physics; Kiev, USSR (10 Oct 1983).

The problem of accuracy estimation in calculation of cross sections and factors of self-screening in the range of non-resolved $^{238}$U resonances is discussed. All the possible sources of errors in results of the calculation are considered. Coefficients of sensitivity of cross sections and factors of self-screening to strength functions and average distances between s- and p-resonances as well as their errors are given. High accuracy of modern estimation of cross sections and factors of self-screening in the region of non-resolved resonances is proved. 4 references, 1 table.

47834 (INIS-SU—301, pp 116-120) **Program complex for calculating the two-particle reaction cross sections.** Titarenko, N.N. (Fiziko-Ehnergeticheskij Inst., Obninsk, USSR). 1984. (In Russian). NTIS (US Sales Only), PC A18/MF A01. File Number DE85781590. (CONF-8310228—Vol.1).

From 6. Soviet national conference on neutron physics; Kiev, USSR (10 Oct 1983).

General structure of the REAK-AB program complex intended for computerized calculation of two-particle nuclear reactions in the energy range up to 100 MeV is described. Basis REAK-AB complex program for calculation of binary reactions by optical (ROM-78), statistical (SMT-80) models, method of distorted waves (VAR-82) and strong bond of channels (SSA-83) are written in the FORTRAN-4 language for BEhSM-6 and ES-1060 type computers. Different angular distributions of two-particle nuclear reactions such as differential cross sections, parameters of vector and sections and strength functions are calculated by these programs. Analysis of data by reactions with polarized targets and targets in the initial state is presupposed, and there is a possibility of automatic search for phenomenological parameters of model by different experimental data in a wide kinematic range. Calculations conducted on the base of basic program complex have revealed that the realized structure is easily modernized and expanded, the system can be used as reliable instrument in fundamental researches. 11 references, 1 figure.

47835 (INIS-SU—301, pp 89-96) **Bayers approach to the parametrization of neutron cross sections simultaneously with transmission functions.** Markovski, B.; Yaneva, N. (Inst. za Yadrena Izsledvaniya i Yadrena Energetika, Sofia, Byelorussian SSR). 1984. (In Russian). NTIS (US Sales Only), PC A18/MF A01. File Number DE85781590. (CONF-8310228—Vol.1).

From 6. Soviet national conference on neutron physics; Kiev, USSR (10 Oct 1983).

Bayes approach for combined analysis of partial neutron cross sections and neutron transmission functions for rather thick samples is applied. Two methods: interference analysis on the base of Adler-Adler formalism in the range of resolved resonances as well as simulation of neutron cross sections and their functionals using Reich-Murr approximation for non-resolved resonances are considered. Dispersions of estimated parameters with and without account of data obtained from the transmission function and self-indication are compared as an intermediate result. Their posterior distribution is used for estimation of parameters, explicit form of the correction to the aprioric value is obtained at variation of parameters. Specified value of resonance parameters at the expense of including data on neutron transmission through thick specimens into analysis of the resonance structure is estimated.

47836 **(INS—483) Energy and momentum dissipations and moving source in a few GeV hadron-nucleus collision.** Ichimura, A.; Sato, H.; Sumiyoshi, H. (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). Nov 1983. 22p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85702104.

Energy and momentum dissipation processes of a few GeV hadron in the nucleus are investigated with a modified Glauber model. The incident energy and target mass dependences of the moving source parameters (velocity, temperature and nucleon multiplicity) are well reproduced, where the moving source is assumed to be formed by absorbing recoil nucleons and pions produced in the collision. The increase and saturation properties of the velocity and temperature parameters with increasing incident energy are discussed in terms of the energy dependent production efficiency of pions in the inelastic process.

47837 **(ITF—83-72-R) Nuclear-coulomb t-matrix for separable potential with real distinguish pecularities.** Navrotskij, M.A. (AN Ukrainskoj SSR, Kiev. Inst. Teoreticheskoj Fiziki). 1983. 25p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE85702105.

The representation of nuclear-Coulomb off-shell t-matrix with separated Coulomb singularities is obtained for the case of separable nuclear potential. It is shown that nuclear-Coulomb scattering length may be defined as a limit of nonsingular component of the nuclear-Coulomb off-shell t-matrix at zero energy and momenta point. In particular, the scattering length may be found as the limit from negative energy range where t-matrix is real.

47838 **(JINR—E-2-84-173) Soliton-like excitations in a one-dimensional nuclear matter.** Barashenkov, I.V.; Makhankov, V.G. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation). 1984. 16p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85702103.

Submitted to the journal J. Phys., A Math. Gen. .

Are considered the nonlinear Schroedinger equation with $phi^3$-$phi^5$ nonlinearity describing static and dynamic properties of heavy ions. Saturating soliton-like solution which can be interpreted as a kernel is explicitly found under the zero boundary conditions. It is demonstrated that the said equation may be used not only to describe the motion of a nucleus as a whole, but also to investigate internal excitations in a nuclear matter. Only hole-like, but no way hump-like stable localized solitons can travel in the nuclear matter. Those solitons when propagating near the velocity of sound are shown to be approximately described by the Kortewegde Vries equation. Also are given exact expressions for them and for some other localized solutions. Stability analysis of the found soliton-like configurations is presented.

47839 **(JINR-R—4-84-638) Nonadiabatic effects and the Coriolis interaction in the odd deformed nuclei.** Kvasil, Ya.; Chariev, M.M.; Tsvek, S.; Kholan, P. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1984. 16p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE85702101.

The alignment of the intrinsic angular momentum along the rotation axis of a nucleus is studied in the framework of the quasiadiabatic model with inclusion of centrifugal and Coriolis interactions. Nonadiabatic corrections and their influence on the description of long rotational bands of odd nuclei is considered. The effect of attenuation of Coriolis interaction as a result of their existence of phonon-quasiparticle components in the intrinsic wave functions of odd nuclear states is discussed. Comparison of the experimental data with theoretical ones is carried out for the case of $^{235}U$ nucleus. The method proposed describes qualitatively well the beginning of the alignment of the intrinsic angular momentum along the rotation axis.

47840 **(Juel-Spez—283) Direct nuclear reactions and the structure of atomic nuclei.** Osterfeld, F. (Kernforschungsanlage Juelich G.m.b.H. (Germany, F.R.). Inst. fuer Kernphysik; Bonn Univ. (Germany, F.R.). Mathematisch-Naturwissenschaftliche Fakultaet). Jan 1985. 158p. (In German). B. File Number DE85752236.

The present thesis deals with two different aspects of direct nuclear reactions, namely on the one hand with the microscopic calculation of the imaginary optical potential for the elastic nucleon-nucleus scattering as well as on the other hand with the microscopic analysis of giant magnetic resonances in atomic nuclei which are excited by (p,n) charge-exchange reactions. In the first part of the thesis the imaginary part of the optical potential for the elastic proton- and neutron-nucleus scattering is microscopically calculated in the framework of the so called nuclear-structure approximation to the optical potential. The calculations are performed in the Feshbach formalism in second-order perturbation theory corresponding to an effective projectile-target-nucleon interaction. In the second part of this thesis in the framework of microscopic nuclear models a complete analysis of different A(p,n)B charge-exchange reactions at high incident energies 160 MeV $<=$ E $<=$ 200 MeV is performed. The nuclear excitation spectra are described either by microscopic RPA wave functions or by generalized RPA+$\Delta$ wave functions which contain explicitely $\Delta$-isobaric degrees of freedom. The scattering cross sections are calculated in the distorted wave impulse approximation. By the microscopic analysis the spectra can be decomposed in states with different multipolarity L respectively spin-parity Jsup($\pi$). In the $^{90}Zr$(p,n) reaction three collective spin-isospin resonances could be uniquely identified.

47841 **(KAERC—4/84) Theoretical study on optical model potential.** Lim Hung Gi. (State Committee for Atomic Energy, Pyongyang (D.P.R. of Korea). Research Center for Atomic Energy.). Aug 1984. 5p. (In Korean). NTIS (US Sales Only), PC A02/MF A01. File Number DE85702102.

The optical model potential of non-local effect on the rounded edge of the potential is derived. On the basis of this potential the functional form of the optical model potential, the energy dependence and relationship of its parameters, and the dependency of the values of the parameters on energy change are shown in this paper.

47842 **(LA-UR—85-2281) Relativistic hydrodynamics, heavy ion reactions and antiproton annihilation.** Strottman, D. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 28p. (CONF-8506178—2). NTIS, PC A03/MF A01; GPO Dep. File Number DE85014069.

From Cretan international meeting on subatomic physics; Crete, Greece (23 Jun 1985).

The application of relativistic hydrodynamics to relativistic heavy ions and antiproton annihilation is summarized. Conditions for validity of hydrodynamics are presented. Theoretical results for inclusive particle spectra, pion production and flow analysis are given for medium energy heavy ions. The two-fluid model is introduced and results presented for reactions from 800 MeV per nucleon to 15 GeV on 15 GeV per nucleon. Temperatures and densities attained in antiproton annihilation are given. Finally, signals which might indicate the presence of a quark-gluon plasma are briefly surveyed.

47843 **(LA-UR—85-2701) Nuclear structure considerations for gamma-ray lasers.** Strottman, D.; Arthur, E.D.; Madland, D.G. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 23p. (CONF-8505174—2). NTIS, PC A02; 3; GPO Dep. File Number DE85015737.

From IDA workshop on gamma-ray lasers; Alexandria, VA, USA (21 May 1985).

Presented are initial results in our investigation of the nuclear physics issues of gamma-ray lasers. These include the questions of what is known from existing experimental data, where does one optimally search for nuclei displaying simultaneously both closely lying levels and nuclear isomerism, and which theoretical models does one employ for systematic searches for candidate nuclei and for calculation of detailed candidate level properties.

47844 **(LA-UR—85-2704) Toward a microscopic understanding of the interacting boson model of nuclei.** Ginocchio, J.N. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 39p. (CONF-8505190—1). NTIS, PC A03/MF A01; GPO Dep. File Number DE85015735.

From 3. Capri symposium on symmetry and supersymmetry in nuclear and subnuclear physics; Capri, Italy (20 May 1985).

Fermion shell model Hamiltonians are constructed which have a class of eigenstates composed of monopole pairs and quadrupole pairs only. Since no boson approximation needs to be made, the Pauli principle is kept intact. Because the $SO_8$ model has a one-to-one correspondence between the space spanned by the fermion states composed of the special monopole and quadrupole pairs of neutrons and protons and the space spanned by the monopole and quadrupole bosons, it is discussed in detail. Recent developments in the $Sp_8$ model are also reported. These two models classify all the shell model states by the number of identical fermion pairs not coupled to coherent monopole or quadrupole pairs. It is suggested that light nuclei may combine features of both $SU_3$ and $SO_8$ symmetry simultaneously. 27 refs., 6 figs., 2 tabs. (LEW)

47845 **(LA-UR—85-3098) Possibilities at LAMPF for studying nuclei of astrophysical interest.** Talbert, W.L. Jr.; Bunker, M.E. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 6p. (CONF-8509148—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85017526.

From TRIUMF accelerated radioactive beams workshop; Parksvill, BC, Canada (4 Sep 1985).

Nuclear data needs in astrophysics range from neutron capture cross sections of a number of stable or near-stable nuclei to decay and neutron binding-energy data for highly neutron-rich nuclei. LAMPF has the potential to contribute significantly to these needs. The new Los Alamos Neutron Scattering Center (LANSCE, aka WNR/PSR) offers world-class capabilities for neutron capture studies up to an MeV or so. The study of nuclei far from stability could be extended into some regions of astrophysical interest using a proposed He-jet coupled mass separator system with a target/production chamber in the LAMPF beam stop area. Specific examples of possible studies at each facility are presented.

47846 **(LBL—19827) Spin-polarization observables in elastic electron scattering from spin-1/2 nuclei.** Conzett, H.E. (Lawrence Berkeley Lab., CA (USA)). May 1985. Contract AC03-76SF00098. 4p. (CONF-850807—5). NTIS, PC A02/MF A01; GPO Dep. File Number DE85016639.

From 6. international symposium on polarization phenomena in nuclear physics; Osaka, Japan (26 Aug 1985).

Using the formalism of nucleon-nucleon scattering as a starting point, electron scattering from spin-1/2 nuclei is examined. It is seen that high-energy electron-nucleon scattering, for example, exhibits a remarkable simplicity when compared with that of nucleon-nucleon scattering. The 6 amplitudes and 36 nucleon-nucleon observables are reduced to 3 and 9, respectively, by the relativistic nature of the electron. The one-photon exchange mechanism finally reduces the number of amplitudes and independent observables to 2. This treatment serves to extend the spin-polarization "language" of hadronic scattering to that of electron scattering also. 6 refs. (LEW)

47847 **(LUNFD6/NFFR—3050/1-198(1983)) Catalogue of gamma rays from radionuclides.** Ekstroem, L.P.; Andersson, P. (Lund Univ. (Sweden). Dept. of Physics). Oct 1983. 198p. NTIS (US Sales Only), PC A09/MF A01. File Number DE85702106.

A catalogue of almost 11000 gamma rays is presented. The gamma rays are sorted by energy. In addition to the gamma-ray intensity per 100 decays of the parent, the decay half-life and associated gamma rays are given. All data are from a computer processing of a recent ENSDF file.

47848 **Brueckner-Bethe and variational calculations of nuclear matter.** Day, B.D.; Wiringa, R.B. (Physics Division, Argonne National Laboratory, Argonne, Illinois 60439). *Physical Review [Section] C: Nuclear Physics;* **32**: No. 3, 1057-1062(Sep 1985). Contract W-31-109-ENG-38.

Results of both Brueckner-Bethe and variational calculations for the binding energy of nuclear matter as a function of density are presented for several recent nucleon-nucleon potentials. A detailed comparison is made for the Argonne $v_{14}$ potential, the most realistic potential for which both methods have been used. The two methods agree reasonably well, with predicted saturation points of -17.8 MeV at 1.6 $fm^{-1}$ for the Brueckner-Bethe method, and -16.6 MeV at 1.7 $fm^{-1}$ for the variational method. The variational energies are 1—2 MeV above the Brueckner-Bethe energies for densities from 1.2 to 1.7 $fm^{-1}$. The results of Brueckner-Bethe calculations are also given for the Paris and Bonn potentials as well as results of variational calculations for the Urbana $v_{14}$ potential. These potentials all give similar binding energy curves, and all saturate matter at a density significantly above the empirical value.

47849 **Incompressibility of neutron-rich nuclear matter.** Prakash, M.; Bedell, K.S. (Physics Department, State University of New York at Stony Brook, Stony Brook, New York 11794). *Physical Review [Section] C: Nuclear Physics;* **32**: No. 3, 1118-1121(Sep 1985). Contract AC02-76ER13001.

The asymmetry dependence of the incompressibility at fixed density, the density at fixed pressure, and the isobaric incompressibility are studied for neutron-rich nuclear matter at arbitrary densities. Simple expressions valid to all orders in density and to second order in asymmetry are derived involving the density derivatives of the Landau parameters of the symmetric system. Illustrative calculations are performed with different equations of state.

47850 **Dispersive effects in pion-nucleus scattering.** Ernst, D.J.; Johnson, M.B. (Physics Department, Texas A&M University, College Station, Texas 77843). *Physical Review [Section] C: Nuclear Physics;* **32**: No. 3, 940-948(Sep 1985).

The influence of dispersive, medium effects on pion-nucleus elastic scattering is investigated in a simple model. The pion-nucleus interaction in the impulse approximation is represented by an optical potential whose form is motivated by field-theoretic considerations and the properties of the $\Delta_{33}$ resonance. The intermediate $\Delta_{33}$ spectrum is described by a mean spectral energy, E/sub ms/, where the shift E/sub ms/ represents the average of the $\Delta_{33}$-nucleus mean field, U/sub Δ/, over the nucleon and pion wave functions. We calculate the real part of E/sub ms/ as a function of mass number A and pion energy ω, assuming that U/sub Δ/ is numerically the same as the nucleon-nucleus shell-model potential. We compare our theory to more conventional ones, showing that the mean spectral energy is an important correction for pion-nucleus elastic scattering.

47851 **Stellar weak interaction rates for intermediate-mass nuclei. IV. Interpolation procedures for rapidly varying Lepton capture rates using effective log (ft) values.** Fuller, G.M.; Fowler, W.A.; Newman, M.J. (Lick Observatory, University of California, Santa Cruz, and Enrico Fermi Institute, University of Chicago). *Astrophysical Journal;* **293**: No. 1, 1-16(1 Jun 1985).

Simple expressions for continuum electron and positron capture phase space factors and the associated neutrino energy loss integrals are presented in terms of standard Fermi integrals. Continuous approximations to the relevant Fermi integrals and their first derivatives are made. These allow the computation of effective log (ft)—values, at each temperature and density point, for the continuum lepton capture rates considered in the earlier papers in this series. Since the effective log (ft)—values have most of the rapid temperature and density dependence associated with the phase space integrals removed, interpolation in temperature and density to obtain stellar rates is greatly facilitated in speed and accuracy. Computer simulations of stellar evolution will be able to implement more accurately our calculations of the stellar nuclear weak interaction rates of intermediate-mass nuclei. Generalization of the Fermi integral expressions for the lepton continuum capture phase space factors are given for astrophysical environments where there exists an equilibrium distribution of electron-type neutrinos. These allow rough estimates of the effect of neutrino blocking on our tabulated rates and estimates of total neutrino capture rates.

47852 **Gamma-ray spectroscopy of hypernuclei.** Chrien, R.E. (Brookhaven National Lab., Upton, NY (USA)). pp 765-792 of Proceedings of the International symposium on in-beam nuclear spectroscopy held at Debrecen, Hungary, 14-18 May 1984. Vol. 2. Dombradi, Zs.; Fenyes, T. (eds.). Budapest, Hungary; Akademiai Kiado (1984). (CONF-840530—Vol.2).

From International symposium on in-beam nuclear spectroscopy; Debrecen, Hungary (14 May 1984).

The study of hypernuclei is a frontier area of nuclear physics. As more intense beams of strange mesons became available, methods of in-beam spectroscopy were applied to the study of hypernuclei. The feasibility of detecting hypernuclear electromagnetic radiation was demonstrated at the Brookhaven Alternating Gradient Synchrotron. Studies were made of the effective Λ hyperon-nucleon interaction in p-shell hypernuclei. The first results are described and they place useful constrains on the effective interaction and the shell model description of hypernuclear states.

## 6540 Radiation And Shielding Physics

*REFER ALSO TO CITATION(S) 46447, 46491*

47853 **(ANL—6170) Heat transfer in thermal radiation absorbing and scattering media.** Viskanta, R. (Argonne National Lab., IL (USA)). May 1960. Contract W-31-109-ENG-38. 200p. NTIS, PC A09/MF A01; GPO Dep. File Number DE84001321.

Thesis. Submitted to Purdue Univ., Lafayette, IN.

The problem of heat transfer from media that absorb and scatter thermal radiation has been studied analytically. The fundamental quantities and definitions of the theory of thermal radiation are presented in a form useful for application to the radiant heat transfer problems. The aim was to formulate the various concepts with maximum generality. The basic equation of radiant heat transfer, which governs the radiation field in a media that absorbs, emits and scatters thermal radiation, has been derived. The mathematical analogy between thermal radiation and neutron transport is pointed out, and a few illustrations of the applicability of the solutions obtained for neutron transport problems to the radiative transfer problems are given. The derivation of the integral equations for radiant heat exchange in a general enclosure composed of a system of surfaces separated by an absorbing and scattering media is presented. The equation for the conservation of energy, including contributions due to thermal radiation, was derived by evaluating the energy transported into an imaginary closed surface fixed in space and then by applying Gauss's divergence theorem. The formulations developed are then used to gain insight into the problem by considering a few simple physical situations and obtaining numerical results for the grey case only. The Rosseland approximation for the radiant flux vector is employed in the study of Couette flow. The temperature distributions were obtained by solving the nonhomogeneous Milne integral equation of the first kind. The transport of energy by simultaneous conduction and radiation in a one-dimensional system has been considered. A nonlinear integral equation governing the temperature distribution in an absorbing media was solved. The presence of radiation generally increases the heat transfer by conduction. 111 refs., 36 figs., 4 tabs.

47854 **(CEA-CONF—7277) Simple model for radiation transport in laser-irradiated targets grouping ETL and coronal ionization.** Di Bona, G.; Babonneau, D.; Bocher, J.L.; Fortin, X.; Valentin, S. (CEA Centre d'Etudes de Limeil, 94 - Villeneuve-Saint-Georges (France)). 1984. 17p. (In French). (CONF-8404252—1). NTIS (US Sales Only), PC A02/MF A01. File Number DE85752181.

From GRECO seminar; Palaiseau, France (26 Apr 1984).

The model presented uses steady-state temperature and density profiles and an atomic physics which groups local and coronal thermodynamic equilibria. Comparisons with Limeil experiments are made.

47855 **(CONF-850871—6) Structure and hydrodynamics of colloidal systems.** Hayter, J.B. (Oak Ridge National Lab., TN (USA)). Jul 1985. Contract AC05-84OR21400. 17p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016294.

From International conference on neutron scattering; Santa Fe, NM, USA (19 Aug 1985).

Colloidal phases (for example, micellar solutions, latex suspensions, ferrofluids and microemulsions) provide excellent model systems with which to test structural and hydrodynamic theories of the liquid state. Interparticle potentials may be attractive or repulsive, and the experimentalist is often free to control the strength, range and symmetry of the interactions. Small-angle neutron scattering (SANS) and small-angle neutron spin-echo (SANSE) provide excellent complementary tools for studying the structure and time-dependence of these systems, where correlation lengths typically vary from about one to several tens of nm. Correlation times are usually in the nsec to μsec range, but may be of order minutes in certain systems. This paper will review some of the current theories and their recent experimental tests, using colloidal systems in which the direct interaction potentials may have spherical, dipolar or cylindrical symmetry and the hydrodynamic interactions may be weak or strong.

47856 **(DOE/ER/75172—2) [American Nuclear Society regional student conferences].** (American Nuclear Society, La Grange Park, IL). Apr 1985. Contract FG02-85ER75172. 45p. (CONF-8504103—Absts.). NTIS, PC A03. File Number DE85016926.

From American Nuclear Society student conference; Gainesville, FL, USA (4 Apr 1985).

The conference transactions include abstracts of presentation in the following sessions: mathematics and computer applications, radioisotopes and applications, criticality and safety, reactor physics, fusion energy, thermal hydraulics, health and medical physics, fuel cycle and waste management, reactor operations, and space remote and material technology. (GHT)

47857 (INIS-SU—301, pp 121-126) **GRUKON applied program package.** Sinitsa, V.V.; Dolgov, E.V.; Koshcheev, V.N.; Nikolaev, M.N. (Fiziko-Ehnergeticheskij Inst., Obninsk, USSR). 1984. (In Russian). NTIS (US Sales Only), PC A18/MF A01. File Number DE85781590. (CONF-8310228—Vol.1).

From 6. Soviet national conference on neutron physics; Kiev, USSR (10 Oct 1983).

Structure and opportunities of GRUKON package for reprocessing estimated neutron data in group microscopic constants are considered. Moduli of the GRUKON package are written in the FORTRAN. 7 references.

47858 **(INIS-SU—301) Neutron physics. Vol. 1.** (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow; AN SSSR, Moscow; AN Ukrainskoj SSR, Kiev; AN Ukrainskoj SSR, Kiev. Inst. Yadernykh Issledovanij; Tsentral'nyj Nauchno-Issledovatel'skij Inst. Informatsii i Tekhniko-Ehkonomicheskikh Issledovanij po Atomnoj Nauke i Tekhnike, Moscow (USSR)). 1984. 407p. (In Russian). (CONF-8310228—Vol.1). NTIS (US Sales Only), PC A18/MF A01. File Number DE85781590.

From 6. Soviet national conference on neutron physics; Kiev, USSR (10 Oct 1983).

Abstracts of individual items from the conference were prepared separately for the data base. (GHT)

47859 **(JAERI-M—84-022) FAIR-DDX: a code for production of double differential cross section library.** Minami, Kazuyoshi; Yamano, Naoki. (Japan Atomic Energy Research Inst., Tokyo). Feb 1984. 50p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. File Number DE85702227.

Recently double differential (energy and angle) cross sections (DDX) have been measured intensively in Osaka and Tohoku Universities. These results give valuable information on the cross sections in high energy region important for fusion neutronics, paticularly on the inelastic scattering. Hence useful feed-back is expected on the evaluation work for JENDL-3 by comparing the evaluation data in JENDL-2 with these experimental DDX data. For this purpose. FAIR-DDX code has been developed to produce the double differential cross sections from JENDL-2 library in Working Group on Group Constants for Fusion and Shielding of Japanese Nuclear Data Committee. This report is a manual of FAIR-DDX, which describes on outline of the code and explain how to use it.

47860 **(KAERC—8/84) Cross factorization for solution of neutron diffusion equation.** Kim Jae Pyong. (State Committee for Atomic Energy, Pyongyang (D.P.R. of Korea). Research Center for Atomic Energy.). Aug 1984. 8p. (In Korean). NTIS (US Sales Only), PC A02/MF A01. File Number DE85702098.

A cross factorization for the solution of the finite difference equation of the neutron diffusion equation is developed for the case of two and three dimensional spaces. In the method factorization is carried out along two directions (three directions in three dimensional case) in the network, and the method has been proved more advanced than the alternating method. The formulas of cross factorizations are derived for the case of two and three dimensional geometries, and the convergence of interaction and the method to determine parameter $\omega$ are investigated.

47861 **(KFK—3914) Improved treatment for determining the group cross section for elastic down-scattering into the adjacent group.** Woll, D. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Neutronenphysik und Reaktortechnik; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Schneller Brueter). Apr 1985. 45p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85752327.

In the group cross section libraries usually applied for reactor calculations, the energy dependent probabilities of interactions between neutrons and the materials existing in the reactor are represented by weighted average values over certain energy ranges with a neutron energy spectrum regarded as representative. The influence of the resonance structure of the cross sections via the neutron spectrum and the resultant effect on the averaged group cross sections is taken into account in an approximate way by so-called resonance self-shielding factors. The approximations indicated are of considerable importance for the elastic down scattering. They can be improved by the so-called REMO correction, which takes into account the neutron energy distribution existing in the reactor model. Because such detailed neutron distributions are very expensive to prepare, especially in multi-dimensional models, automatic program runs were established which, in some cases by simplifications of the model, allow collision densities to be made available at relatively little expenditure which permit many nuclear quantities to be calculated with a sufficient degree of accuracy. This report describes the program runs set up and the experience acquired in testing them by the examples of the MASURCA 3B experiment and the SNEAK 11B2 assembly. This report deals especially with the influence of the collision density used for the REMO correction on the ksub(eff) value and other parameters of the reactor models considered.

47862 **(LA—10375-PR) Radiation transport. Progress report, April 1, 1984-June 30, 1984.** O'Dell, R.D. (Los Alamos National Lab., NM (USA)). May 1985. Contract W-7405-ENG-36. 53p. NTIS, PC A04/MF A01; GPO Dep. File Number DE85017958.

Research and development progress in radiation transport by the Los Alamos National Laboratory's Group X-6 for the third quarter of FY 84 is reported. Included are unclassified tasks in the areas of Fission Reactor Neutronics, Deterministic Transport Methods, Monte Carlo Radiation Transport, and Cross Sections and Physics.

47863 **(NIIAR—10(622)) Solution properties of the nonstationary multigroup diffusion transport problem with regard to delayed neutrons.** Makin, R.S. (Nauchno-Issledovatel'skij Inst. Atomnykh Reaktorov, Dimitrovgrad (USSR)). 1984. 26p. (In Russian). NTIS (US Sales Only), PC A03/MF A01. File Number DE85702099.

Non stationary problems for diffusion multigroup approximation with due regard for the delayed nutrons and the multigroup $P_1$ approximation are studied. In case of problem parameters independent of time, the conditions of exponential asymptotics existence are obtained. The properties of the given problem solutions, when diffusion coefficients are constant in time and the cross sections are its functions are considered. In case of a periodic parametric effect the conditions for validity of the Flouquet asymptotic presentation are formulated.

## 6550 Medical Physics

*REFER ALSO TO CITATION(S) 47128, 47232, 47307, 47396*

47864 **(CONF-840512—23) Alpha particle analysis using PEARLS spectrometry.** McKlveen, J.W.; Klingler, G.W.; McDowell, W.J.; Case, G.N. (Arizona State Univ., Tempe (USA). Coll. of Engineering and Applied Sciences; Oak Ridge National Lab., TN (USA)). 1984. Contract AC05-84OR21400. 5p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016144.

From 6. congress of the International Radiation Protection Association; Berlin, F.R. Germany (7 May 1984).

Alpha particle assay by conventional plate-counting methods is difficult because chemical separation, tracer techniques, and/or self-absorption losses in the final sample may cause either non-reproducible results or create unacceptable errors. PEARLS (Photon-Electron Rejecting Alpha Liquid Scintillation) Spectrometry is an attractive alternative since radionuclides may be extracted into a scintillator in which there would be no self-absorption or geometry problems and in which up to 100% chemical recovery and counting efficiency is possible. Sample preparation may include extraction of the alpha emitter of interest by a specific organic-phase-soluble compound directly into the liquid scintillator. Detection electronics use energy and pulse-shape discrimination to provide discrete alpha spectra and virtual absence of beta and gamma backgrounds. Backgrounds on the order of 0.01 cpm are readily achievable. Accuracy and reproducibility are typically in the 100 +-1% range. Specific procedures have been developed for gross alpha, uranium, plutonium, thorium, and polonium assay. This paper will review liquid scintillation alpha counting methods and reference some of the specific applications. 8 refs., 1 fig.

47865 **(FNAL-TM—1296) Dependence of charge collection distributions and dose on the gas type filling the ionization chamber for a p(66)Be(49) clinical neutron beam.** Awschalom, M.; Haken, R.K.T. (Fermi National Accelerator Lab., Batavia, IL (USA)). Jan 1985. Contract AC02-76CH03000. 33p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85017366.

Measurements of central axis depth charge distributions (CADCD) in a p(66)Be(49) clinical neutron beam using A-150 TE plastic ionization chambers (IC) have shown that these distributions are dependent on the gas type filling the ICs. IC volumes from 0.1 to 8 $cm^3$ and nine different gases were investigated. Off axis ratios and build-up measurements do not seem to be as sensitive to gas type. The gas dosimetry constants given in the AAPM Protocol for Neutron Beam Dosimetry for air and methane based TE gases were tested for consistency in water and in TE solution filled phantoms at depths of 10 cm, when used in conjunction with an IC having 5 mm thick walls of A-150. 29 refs., 7 figs., 1 tab.

47866 **(INFO—0097) Approach to the calculation of dose commitment arising from different methods for the long-term management of uranium mill tailings. Summary report.** (Atomic Energy Control Board, Ottawa, Ontario (Canada); IEC Beak Consultants Ltd., Mississauga, Ontario (Canada)). Jul 1983. 71p. NTIS (US Sales Only), PC A04/MF A01. File Number DE85702145.

This report describes the development and use of a diagnostic model designed to improve our understanding of the release of radionuclides to the natural environment from uranium mill tailings management areas. The study first developed the characteristics of a hypothetical tailings management area such that a variety of management alternatives could be studied using simulation modelling techniques. Factors describing climate and the surrounding environment were fixed and the simulation model was run to predict releases from the tailings site over time periods of thousands of years. Simulation runs were carried out for a series of six major management alternatives ranging from old abandoned practices through currently accepted practices to as yet to be proven management techniques. This summary report describes the major aspects of the diagnostic model and the findings obtained through its use. The report does not attempt to predict doses or radionuclide dispersal patterns for any specific site, existing or planned. A more complete

technical discussion of the model may be found in the two technical appendices associated with this report INFO--0097 (app.A.) and INFO--0097 (app.B).

47867 **(INFO—0097-App.A) Atmospheric dispersion of radionuclides from uranium mill tailings disposal sites. Technical appendix.** (Atomic Energy Control Board, Ottawa, Ontario (Canada); IEC Beak Consultants Ltd., Mississauga, Ontario (Canada)). Mar 1983. 147p. NTIS (US Sales Only), PC A07/MF A01. File Number DE85702146.

This report describes the study of generation and dispersion of airborne radionuclide species from an hypothetical tailings disposal site. The radionuclides are followed along atmospheric dispersion pathways. Estimates of public radiation dose impact were made based on: 1) the behaviour of the hypothetical site and tailings; 2) atmospheric dispersion from such a site located in Northern Ontario. This, the 'Atmospheric Technical Appendix' describes important aspects of the atmospheric modelling process, and findings resulting from that process. It does not attempt to predict real radiation doses, or real atmospheric radionuclide dispersion patterns for any specific site whether existing or projected.

47868 **(INFO—0097-App.B) Approach to the calculation of dose commitment arising from different methods for the long-term management of uranium mill tailings through aquatic pathways. Technical appendix.** (Atomic Energy Control Board, Ottawa, Ontario (Canada); IEC Beak Consultants Ltd., Mississauga, Ontario (Canada)). 1983. 279p. NTIS (US Sales Only), PC A13/MF A01. File Number DE85702147.

This report describes the development and use of the aquatic pathway portion of a diagnostic model. The model was developed as part of a study intended to improve methods for estimating the environmental dispersion of radionuclides from uranium mill tailings disposal sites. This, the aquatic portion of the study, investigates radionuclide dispersion through aquatic pathways from a hypothetical mill tailings disposal site and presents dose commitment calculations for human exposure to the simulated patterns of radionuclide concentrations over time. Dose commitment estimates are made, based on the simulated geochemical behaviour of the hypothetical site and tailings, aquatic dispersion from the generic site located in northern Ontario and human exposure to and utilization of aquatic products (fish, water). The dose commitment estimates are presented based upon a range of input variable assumptions. This, the 'Aquatic Technical Appendix', describes all important aspects of: the aquatic portion of the diagnostic model, the modelling of the hypothetical tailings site and tailings mass, and findings resulting from use of the models. This report does not predict real radiation doses, or real radionuclide dispersion patterns for any site whether existing or projected.

47869 (INIS-mf—9743, pp 50-51) **Dosimetry systems and data processing techniques used with $^{60}$Co sources.** Pesek, M. (Ustav pro Vyzkum, Vyrobu a Vyuziti Radioisotopu, Prague (Czechoslovakia)). 1984. (In Czech). NTIS (US Sales Only), PC A04/MF A01. File Number DE85781606. (CONF-8411173—).

From Seminar on application of ionizing radiation in foods and feeds treatment; Prague, Czechoslovakia (28 Nov 1984).

Published in summary form only.

47870 **(PTB-Dos—10) Radiation emission from data display terminals.** Lauterbach, U. (Physikalisch-Technische Bundesanstalt, Braunschweig (Germany, F.R.). Gruppe Photonen- und Elektronendosimetrie). Dec 1984. 24p. (In German). B. File Number DE85752248.

An extensive collection of data has been accumulated meanwhile within the framework of design examinations for approval of equipment, the data referring to the dose rate of the X-radiation emitted by the device at a distance of 5 cm from the touchable surface, to operational characteristics such as high voltages and beam currents, and to the intended range of application. An evaluation of the data as presented in this report shows that today's technical know-how in this field and appropriate circuit design enables currently available data display terminals to operate safely within the limits set by the X-ray Ordinance.

47871 **(SSI-A—84-16) Mailing radioactive materials in Sweden.** Bennerstedt, T. (Statens Straalskyddsinstitut, Stockholm (Sweden); International Atomic Energy Agency, Vienna (Austria)). Jun 1984. 9p. (CONF-831043—1; IAEA-SR—83-5). NTIS (US Sales Only), PC A02/MF A01. File Number DE85702148.

From Seminar on transport of radioactive material by post; Vienna, Austria (24 Oct 1983).

Postal movement of radioactive materials is not generally permitted in Sweden. For radioactive sources other than - single items of approved consumer products - materials of low specific activity (less than 2 nCi/g) - naturally occurring radioactive material, a license is required. Licenses are issued by the Swedish Post Office after consultations with the National Institute of Radiation Protection. The activity limit is the ALI, which in most cases is well below the IAEA limit. The surface dose rate limit, 0.1 mrem/h, is one fifth of the IAEA limit. The packaging requirements are basically the same as those of the IAEA. No external marking is required in Sweden.

47872 **Monte Carlo primer for health physicists.** Turner, J.E.; Wright, H.A.; Hamm, R.N. (Oak Ridge National Lab., TN). *Health Physics;* **48**: No. 6, 717-733(Jun 1985). Contract AC05-84OR21400.

The basic ideas and principles of Monte Carlo calculations are presented in the form of a primer for health physicists. A simple integral with a known answer is evaluated by two different Monte Carlo approaches. Random number, which underlie Monte Carlo work, are discussed, and a sample table of random numbers generated by a hand calculator is presented. Monte Carlo calculations of dose and linear energy transfer (LET) from 100-keV neutrons incident on a tissue slab are discussed. The random-number table is used in a hand calculation of the initial sequence of events for a 100-keV neutron entering the slab. Some pitfalls in Monte Carlo work are described. While this primer addresses mainly the bare bones of Monte Carlo, a final section briefly describes some of the more sophisticated techniques used in practice to reduce variance and computing time.

## 6560 Solid-state Physics

*REFER ALSO TO CITATION(S) 46792, 47897*

47873 **(LA-UR—85-3064) Energy dispersive spectroscopy using synchrotron radiation: intensity considerations.** Skelton, E.F.; Elam, W.T.; Qadri, S.B.; Webb, A.W.; Schiferl, D. (Naval Research Lab., Washington, DC (USA); Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 21p. (CONF-850759—13). NTIS, PC A02/MF A01; GPO Dep. File Number DE85017530.

From 10. high pressure conference on research in high pressure science and technology; Amsterdam, Netherlands (8 Jul 1985).

Detailed considerations are given to the reliability of energy dependent integrated intensity data collected from the pressure cavity of a diamond-anvil pressure cell illuminated with heterochromatic radiation from a synchrotron storage ring. It is demonstrated that at least in one run, the electron beam current cannot be used to correct for energy-intensity variations of the incident beam. Rather there appears to be an additional linear relationship between the decay of the synchrotron beam and the magnitude of the background intensity. 13 refs., 7 figs.

47874 **(RISO-R—517) Physics Department annual progress report 1 January-31 December 1984.** Als-Nielsen, J.; Lebech, B.; Juul Rasmussen, J. (eds.). (Risoe National Lab., Roskilde (Denmark)). Feb 1985. 95p. NTIS (US Sales Only), PC A05/MF A01. File Number DE85781588.

Abstracts of individual items from the report were prepared separately for the data base. (GHT)

47875 **(UCRL—92565) Atom-in-jellium models.** Liberman, D.A. (Lawrence Livermore National Lab., CA (USA)). 26 Apr 1985. Contract W-7405-ENG-48. 21p. (CONF-8505196—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85016075.

From Limeil Laboratory of the French Atomic Energy Commission meeting; Paris, France (6 May 1985).

The author describes in this paper the atom-in-jellium calculations he has been doing over the last ten years. He tries to emphasize reasons for doing this sort of calculations and why he devised a model which is different in some respects from others.

## 6561 Superconductivity

*REFER ALSO TO CITATION(S) 46717, 46927*

47876 **(IS-T—1181) Theory of flux-line cutting and the critical state in type-II superconductors.** Perez-Gonzalez, A. (Ames Lab., IA (USA)). Jul 1985. Contract W-7405-ENG-82. 168p. NTIS, PC A08/MF A01; GPO Dep. File Number DE85017347.

Thesis.

A general critical-state theory, which includes both flux pinning and flux-line cutting, is presented. The electromagnetic response of a type-II superconducting slab subjected to a parallel, constant magnetic field whose direction undergoes either continuous rotation or periodic oscillation is investigated. Vector B, vector J, and vector E field distributions during the approach to quasi-steady state of a slab subjected to a parallel rotating magnetic field are calculated. It is shown that, regardless of the specimen's magnetic history, flux-line-cutting B-consumption leds to a final state in which B has a diamagnetic profile near the surface of the specimen. Hysteretic losses in samples subjected to an oscillating magnetic field oriented at an arbitrary angle with respect to a bias field, both fields being parallel to the surface, are discussed. Analytic expressions for the ac losses are obtained for the case that the amplitude of the oscillating field is small compared with the bias field. The calculations are generalized for the case of arbitrary B dependence of the parameters of the theory, and for arbitrarily large amplitude of the ac field. Numerical solutions to the equations describing the theory are presented.

47877 **(IS-T—1192) Theory of critical currents and perpendicular upper critical fields for superconducting proximity systems.** Biagi, K.R. (Ames Lab., IA (USA)). Jul 1985. Contract W-7405-ENG-82. 104p. NTIS, PC A06/MF A01; GPO Dep. File Number DE85017170.

Thesis.

The maximum supercurrent that can be carried in an applied perpendicular magnetic field by a superconducting-normal-metal-superconducting (SNS) junction consisting of a square normal-metal layer sandwiched between two crossed perpendicular superconducting strips is investigated theoretically. For weak applied fields, the critical current is suppressed reversibly, as induced Meissner screening currents flow into the SNS sandwich and generate a spatially varying magnetic field largely parallel to the junction, thereby altering the local phase difference. For stronger applied fields, the critical current is changed irreversibly as vortices enter and become pinned in the junction. When the pinned vortices in the two superconductors are misaligned, the local magnetic field, which flows mostly parallel to the junction in carrying magnetic flux from one vortex to the other, strongly alters the phase difference across the junction near the two vortices. The theory predicts complex patterns of the supercurrent density, which should be directly observable using laser or electron-beam scanning techniques. Eilenberger's quasi-classical formulation of superconductivity is used to derive an equation for the upper critical field of a multilayered SN system in a perpendicular magnetic field. The alternating layers are coupled via the proximity effect and are in the dirty limit. Comparison with experimental data for Nb/Cu multilayers shows good agreement only if the mean free paths are substantially smaller than those obtained from longitudinal resistivity measurements. One feature of this theory is the presence of positive curvature in the upper critical field near the critical temperature.

47878 **(JINR—R-8-84-547) Influence of a restricted normal zone on the limiting current of a superconducting cable and field distribution in the aperture of a dipole magnet.** Zajtsev, S.L.; Petrova, L.V.; Reshetnikov, G.P.; Yudin, I.P. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy). 1984. 8p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE85702083.

The values of limiting current in transverse magnetic fields of 0.5-5.3 T have been measured for samples of a superconducting (SC) cable with a specially created restricted normal zone (RNZ) in the form of copper insertions. Harmonic amplitudes of the magnetic field in the SC-dipole aperture have been calculated in the two-dimensional approximation for similar RNZs producing the redistribution of current density in the cable section. The behaviour of the harmonic amplitudes are in qualitative agreement with the results of measurements performed previously under subcritical pulsed heating as a function of the depth of penetration into RNZ in the SC cable.

47879 **(JINR—R-17-84-107) Thirring approximation in the microscopic two-liquid model for a superconductor.** Mezhov, V.I.; Shumovskij, A.S.; Yaroslavtsev, V.I. (Joint Inst. for Nuclear Research, Dubna (USSR)). 1984. 8p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE85702082.

Submitted to the journal Theor. Math. Phys. .

The microscopic two-liquid model for a superconductor is examined in the Thirring approximation. An additional order parameter (phase concentration) is determined as a function of temperature. A generalized equation for an ordinary order parameter (gap) is obtained. The change of the phase transition type due to Coulomb interaction is investigated.

## 6570 Theoretical Physics

*REFER ALSO TO CITATION(S) 47522*

47880 **(CEA-N—2419) Survey on Dirac equation in general relativity theory.** Paillere, P. (CEA Centre d'Etudes de Limeil, 94 - Villeneuve-Saint-Georges (France)). Oct 1984. 201p. (In French). NTIS (US Sales Only), PC A10/MF A01. File Number DE85752140.

Starting from an infinitesimal transformation expressed with a Killing vector and using systematically the formalism of the local tetrades, we show that, in the area of the general relativity, the Dirac equation may be formulated only versus the four local vectors which determine the gravitational potentials, their gradients and the 4-vector potential of the electromagnetic field.

47881 **(DOE/ER/13121—T1) Resonance in weakly nonlinear systems. Progress report, August 1, 1984-March 31, 1985.** Kevorkian, J. (Washington Univ., Seattle (USA)). 1985. Contract AT06-83ER13121. 82p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE85015287.

Research is reported in these areas: adiabatic invariants intransient resonance, survey of results for systems with slowly varying parameters, and free-electron laser dynamics and instabilities. (GHT)

47882 **(DOE/ER/45135—12) Quantum distribution functions in non-equilibrium statistical mechanics.** O'Connell, R.F. (Louisiana State Univ., Baton Rouge (USA). Dept. of Physics and Astronomy). 1984. Contract AS05-79ER10459;FG05-84ER45135. 13p. (CONF-8406194—4). NTIS, PC A02/MF A01; GPO Dep. File Number DE85016841.

From NATO advanced study institute on nonequilibrium quantum statistical mechanics; Santa Fe, NM, USA (3 Jun 1984).

As we have emphasized in previous investigations of this question, the optimum approach to the problem is via the use of characteristic functions, which are nothing more than Fourier transforms of distribution distributions. The next step is to write P/ sub w/(q,p) in terms of the complex variable $\alpha$. Then we obtain relationships between the various distribution functions, which are

readily converted into relationships between the distribution functions, either in q-p or $\alpha$ language. For simplicity, we treat a one-dimensional system in a pure state since the case of a mixture in multi-dimensions presents no essential complications. Since the touchstone of our considerations is the Wigner distribution, we write down its properties. We then summarize the properties of the generalized distribution functions of the Cahill-Glauber class and their relation to the Wigner distribution. In addition, we discuss the Husimi (smoothed) distribution function and point out its exact equivalence with the anti-normal distribution. We discuss the Glauber-Sudarshan P ($\alpha$) function as well as the Q($\alpha$) function and also the relation between them and P/sub w/. Then we show that the Q($\alpha$), Husimi and anti-normal distributions are identical to each other and, similarly, the Glauber-Sudarshan and normal distributions are identical. Finally, we introduce a new class of generalized distribution functions, with emphasis on two particular cases of same viz., the standard of anti-standard distributions, and we also demonstrate the equivalence of the latter to the Kirkwood distribution. 19 refs.

47883 **(IFVE-OTF—84-137) Quantization of the Lee static model using N.N. Bogolyubov transformation.** Bornyakov, V.G. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1984. 12p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE85702043.

The quantization of the Lee static model is considered with the Bogolybov transformation for creation and annihilation operators. The ground state energy and the scattering matrix in the first non-vanishing order of the expansion in reverse powers of the coupling constant have been obtained. It is shown, how one may remove supplementary zero modes.

47884 **(IFVE-OTF—84-170) Relativistic gravitation theory.** Logunov, A.A.; Mestvirishvili, M.A. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Serpukhov. Inst. Fiziki Vysokikh Ehnergij). 1984. 24p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE85702044.

On the basis of the special relativity and geometrization principle a relativistic gravitation theory (RGT) is unambiguously constructed with the help of a notion of a gravitational field as a physical field in Faraday-Maxwell spirit, which posesses energy momentum and spins 2 and 0. The source of gravitation field is a total conserved energy-momentum tensor for matter and for gravitation field in Minkowski space. In the RGT conservation laws for the energy momentum and angular momentum of matter and gravitational field hold rigorously. The theory explains the whole set of gravitation experiments. Here, due to the geometrization principle the Riemannian space is of a field origin since this space arises effectively as a result of the gravitation field origin since this space arises effectively as a result of the gravitation field action on the matter. The RGT astonishing prediction is that the Universe is not closed but "flat". It means that in the Universe there should exist a "missing" mass in some form of matter.

47885 **(INIS-mf—9350) Almost periodic Schroedinger operators.** Bellissard, J.; Lima, R.; Testard, D. (Forschungszentrum Bielefeld-Bochum-Stochastik (BiBoS), Bielefeld (Germany, F.R.)). Nov 1984. 65p. NTIS (US Sales Only), PC A04/MF A01. File Number DE85781589.

These lectures are devoted to recent developments in the theory of almost-periodic Schroedinger Operators. We specially describe the algebraic point of view, with applications to gap-labelling theorems. Particular models are also presented which exhibit various spectral properties. (orig.).

47886 **(JINR—R-2-84-111) Model-independent description of spontaneously broken N=1 supergravity in superspace.** Ivanov, E.A.; Kapustnikov, A.A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics). 1984. 10p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE85702045.

Submitted to the journal Phys. Lett., B.

A model-independent geometric description of spontaneously broken conformal and minimal Einstein N=1 supergravities in superspace via a nonlinear realization of the Ogievetsky-Sokatchev infinite dimensional supergroup is given. The relation between the nonlinear and conventional superfield realizations of plane N=1 supersymmetry is generalized for a curved case.

47887 **(KMU-HEP—84-08, pp 66-68) Stochastic quantization and supersymmetry.** Kirschner, R. (Karl-Marx-Universitaet, Leipzig (German Democratic Republic). Sektion Physik). Jun 1984. NTIS (US Sales Only), PC A06/MF A01. File Number DE85781587. (CONF-8403194—).

From 15. spring symposium on high energy physics; Georgenthal, German D.R. (26 Mar 1984).

It is shown the supersymmetry mechanism responsible for the quantization by stochastic relaxation processes and for the effective reduction of the additional time dimensions against the two Grassmann dimensions. The validity of this quantization procedure is proved non-perturbatively.

47888 **(UCRL—93152) Destruction of the fractional quantum Hall effect by disorder.** Laughlin, R.B. (Lawrence Livermore National Lab., CA (USA)). Jul 1985. Contract W-7405-ENG-48. 14p. (CONF-8509143—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85016948.

From Yamada conference on electronic properties of two-dimensional systems; Kyoto, Japan (9 Sep 1985).

It is suggested that Hall steps in the fractional quantum Hall effect are physically similar to those in the ordinary quantum Hall effect. This proposition leads to a simple scaling diagram containing a new type of fixed point, which is identified with the destruction of the fractional states by disorder. 15 refs., 3 figs.

47889 **Critique of the Brownian approximation to the generalized Langevin equation in lattice dynamics.** Diestler, D.J.; Riley, M.E. (Department of Chemistry, Purdue University, West Lafayette, Indiana 47907). *Journal of Chemical Physics;* **83**: No. 7, 3584-3589(1 Oct 1985). Contract AC04-76DP00789.

We consider the classical motion of a harmonic lattice in which only those atoms in a certain subset of the lattice (primary zone) may interact with an external force. The formally exact generalized Langevin equation (GLE) for the primary zone is an appropriate description of the dynamics. We examine a previously proposed Brownian, or frictional damping, approximation that reduces the GLE to a set of coupled ordinary Langevin equations for the primary atoms. It is shown that the solution of these equations can contain undamped motion if there is more than one atom in the primary zone. Such motion is explicitly demonstrated for a model that has been used to describe energy transfer in atom—surface collisions. The inability of the standard Brownian approximation to yield an acceptable, physically meaningful result for primary zones comprising more than one atom suggests that the Brownian approximation may introduce other spurious dynamical effects. Further work on damping of correlated motion in lattices is needed.

47890 **Reply to "Comment on 'Transmit versus receive gains for microwave dish antennas' [J. Appl. Phys. 54, 3528 (1983)]".** Richter, J.L. (Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Journal of Applied Physics;* **58**: No. 7, 2763-2763(1 Oct 1985).

A. W. Love points out three alleged errors in our paper [J. Appl. Phys. 54, 3528 (1983)]. We agree that he is correct with regard to the second and third issues, but the first and perhaps most important point is correct. This regards the inequality of transmit and receive patterns of microwave antennas. The standard proof of equality of the patterns, cited by A. W. Love, is shown to be incorrect.

47891 **Markovian field-theoretic approach to the Eden model for kinetic growth.** Shapir, Y. (Physics Department, Brookhaven National Laboratory, Upton, New York 11973). *Physical Review [Section] A: General Physics;* **32**: No. 4, 2552-2553(Oct 1985). Contract AC02-76CH00016.

A novel Hamiltonian approach to generate all possible histories of Eden clusters is presented. It yields a field-theoretic formula-

tion which is local and Markovian. The method may be generalized to other kinetic-growth and aggregation processes.

47892 **Physical content of the orthogonalized final-state rule of Davis and Feldkamp.** Green, T.A. (Sandia National Laboratories, Albuquerque, New Mexico 87185). *Physical Review [Section] B: Condensed Matter;* **32**: No. 6, 3442-3445(15 Sep 1985). Contract AC04-76DP00789.

The orthogonalized final-state rule for x-ray absorption and emission is discussed in the light of an earlier paper by Friedel, and in the light of subsequent papers by Ramaker, and by von Barth and Grossman. It is pointed out that the orthogonalized final-state (OFS) rule deals only with the excitonic enhancement of the final-state-rule transition probability. For the models used by Davis and Feldkamp, von Barth and Grossman, and Friedel, it is shown that the orthogonalized final-state rule yields an excitonic Fermi-edge singularity which is the logarithm of the generally accepted one, and thus underestimates the excitonic enhancement near the Fermi edge. Away from the Fermi edge, the OFS rule should provide a useful evaluation of the excitonic enhancement, as was shown by Davis and Feldkamp and in their paper proposing the OFS rule.

47893 **Rotationally invariant correlation filtering.** Schils, G.F.; Sweeney, D.W. (Sandia National Laboratories, Livermore, California 94550). *Journal of the Optical Society of America A: Optics and Image Science;* **2**: No. 9, 1411-1418(Sep 1985).

A method is presented for analyzing and designing optical correlation filters that have tailored rotational invariance properties. The concept of a correlation of an image with a rotation of itself is introduced. A unified theory of rotation-invariant filtering is then formulated. The unified approach describes matched filters (with no rotation invariance) and circular-harmonic filters (with full rotation invariance) as special cases. The continuum of intermediate cases is described in terms of a cyclic convolution operation over angle. The angular filtering approach allows an exact choice for the continuous trade-off between loss of the correlation energy (or specificity regarding the image) and the amount of rotational invariance desired.

47894 **Quantum tunneling using discrete-time operator difference equations.** Bender, C.M.; Cooper, F.; O'Dell, J.E.; Simmons a.L.M. Jr. (Department of Physics, Washington University, St. Louis, Missouri 63130). *Physical Review Letters;* **55**: No. 9, 901-903(26 Aug 1985).

Canonical discrete-time operator difference equations are introduced as an alternative approach to the numerical solution of a quantum field theory. We apply these techniques to the solution of the operator Heisenberg equations of motion describing the problem of quantum-mechanical tunneling. Our numerical solutions accurately depict the time evolution of <q/sup n/> and of a local probability measure.

47895 **Natural engines.** Wheatley, J.; Cox, A. (University of California-Los Alamos). *Physics Today;* **38**: No. 8, 50-58(Aug 1985).

'Taconis oscillations,' the oscillations of some variable stars, and a novel form of engine are all based on cycles that involve an intrinsically irreversible process and a broken thermodynamic symmetry.

47896 **Secular stability limits for rotating polytropic stars.** Imamura, J.N.; Friedman, J.L.; Durisen, R.H. (Los Alamos National Laboratory). *Astrophysical Journal;* **294**: No. 2, 474-478(15 Jul 1985).

The Lagrangian variational principle is used to numerically locate the secular stability limits of rotating polytropes to nonaxisymmetric perturbations. It has been suggested that nonaxisymmetric modes, with exp (imphi) azimuthal dependence, set upper bounds on the rotation rate of compact stars when driven by gravitational radiation reaction. The results of this paper show that, in contrast to the m = 2 bar mode, the secular stability limits for modes with m>2 are quite sensitive to the compressibility and angular momentum distribution of the polytrope. Because of this, the secular stability characteristics of rotating bodies must be determined independently for each equation of state and angular momentum distribution of interest. Specifically, we find: (1) For a given compressibility and angular momentum distribution, the onset of instability of modes with successively higher m values occurs at successively smaller values of the t-parameter (the ratio of the rotational kinetic energy to the absolute value of the gravitational energy of the polytrope). (2) For a given compressibility, the stability limits in terms of the t-parameter decrease as the angular momentum distribution becomes more peaked near the equator of the star. (3) For a given angular momentum distribution, the stability limits in terms of the t-parameter reach a minimum value at the compressibility for which the equilibrium model is most nearly in uniform rotation at the instability point. (4) When n< or =3/2, instability to the m = 3 and higher modes always sets in prior to termination of a uniformly rotating equilibrium sequence, that is, before the star's equator rotates at Keplerian orbital velocity.

47897 **Propagation of sound at continuous structural phase transitions.** Schwabl, F. (Physik-Department, Technische Universitaet Muenchen, D-8046 Garching, West Germany). *Journal of Statistical Physics;* **39**: No. 3, 719-768(Jun 1985). Contract AC02-76CH00016.

Structural phase transitions of second order can be divided into two groups: (i) distortive phase transitions, with a soft (ultimately overdamped) optic mode, and (ii) elastic phase transitions, with an acoustic soft mode or no soft phonon for shear or isostructural transitions, respectively. The propagation of sound shows significantly different features in these two cases. We consider the theory of the critical variation of the velocity of ultrasonic modes as well as the damping and dispersion near transitions of second order.

47898 **Aspects of soliton propagation in stimulated raman scattering.** Druehl, K.J.; Carlsten, J.L.; Wenzel, R.G. (Institute for Modern Optics, University of New Mexico, Albuquerque, Nex Mexico 87131). *Journal of Statistical Physics;* **39**: No. 3, 615-620(Jun 1985).

Numerical solutions are obtained to the equations describing SRS for optical pulses of finite duration. (AIP)

### 6580 Mathematical Physics

*REFER ALSO TO CITATION(S) 47615*

47899 **Renormalization of mappings of the two-torus.** Kim, S.; Ostlund, S. (Physics Department, University of Pennsylvania, Philadelphia, Pennsylvania 19104). *Physical Review Letters;* **55**: No. 11, 1165-1168(9 Sep 1985). Contract AC02-83ER13044.

We show how a generalization of continued fractions can be used to develop a renormalization-group formalism to study the behavior of maps of the two-torus. Such maps may mimic the universal behavior of dynamical systems with three mutually incommensurate frequencies. Numerical evidence indicates that "chaos" may occur in maps which are invertible. While we do not see scaling at chaos onset, subcritical scaling is observed and explained by the number theory.

## 70 FUSION ENERGY

*REFER ALSO TO CITATION(S) 47856*

### 7001 Plasma Research

*REFER ALSO TO CITATION(S) 46241, 46814, 47169*

47900 **(CONF-8508113—1) Submillimeter wave propagation in tokamak plasmas.** Ma, C.H.; Hutchinson, D.P.; Staats, P.A.; Vander Sluis, K.L.; Mansfield, D.K.; Park, H.; Johnson, L.C. (Oak Ridge National Lab., TN (USA); Princeton Univ., NJ (USA)). 1985. Contract AC05-84OR21400. 7p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85016292.

From International symposium on antennas and EM theory; Beijing, China (25 Aug 1985).

The propagation of submillimeter-waves (smm) in tokamak plasmas has been investigated both theoretically and experimentally to ensure successful measurements of electron density and plasma current distributions in tokamak devices. Theoretical analyses have been carried out to study the polarization of the smm waves in TFTR and ISX-B tokamaks. A multichord smm wave interferometer/polarimeter system has been employed to simultaneously measure the line electron density and poloidal field-induced Faraday rotation in the ISX-B tokamak. The experimental study on TFTR is under way. Computer codes have been developed and have been used to study the wave propagation and to reconstruct the distributions of plasma current and density from the measured data. The results are compared with other measurements.

47901 **(INIS-mf—9902) 15th AINSE plasma physics conference. 4th-6th February 1985, Lucas Heights - AINSE Theatre. Conference handbook.** (Australian Inst. of Nuclear Science and Engineering, Lucas Heights). Feb 1985. 90p. (CONF-850231—Absts.). NTIS (US Sales Only), PC A05/MF A01. File Number DE86780004.

From 15. plasma physics conference; Lucas Heights, Australia (4 Feb 1985).

Separate abstracts were prepared for papers from the AINSE plasma physics conference which was held in Australia, 4-6 February, 1985.

47902 **(IPPJ—661) Enhancement of the excitation and deexcitation rate coefficients of ions in dense plasmas. The role of autoionizing states.** Fujimoto, Takashi; Kato, Takako. (Nagoya Univ. (Japan). Inst. of Plasma Physics). Dec 1983. 26p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85702062.

In processes of excitation-deexcitation and ionization-recombination of ions immersed in dense plasmas, multistep processes through various intermediate states are important. In the present paper we deal with the excitation and deexcitation that have doubly excited, or autoionizing, states as intermediate states. We call these the DL processes. Hydrogen-like 1s <-> 2l ( l = s or p) transitions are considered for the purpose of illustration. The DL excitation rate coefficient is obtained as a function of electron density with an approximation that is based on the picture of dielectronic capture of the 1s ion into the doubly excited states followed by the collisional ladder-like excitation-ionization chain. The DL deexcitation rate coefficient results from autoionization of the doubly-excited- level ions that are in LTE with respect to the 2l-level populations. Both the rate coefficients are interpreted as an extrapolation of the excitation cross section due to lowering of the threshold energy of the 1s → 2l excitation and are found to obey the principle of detailed balance. Thus, the DL processes may be regarded as enhancements of the direct excitation and deexcitation. Detailed collisional-radiative-model calculation which includes 60 doubly excited levels and relevant collisional and radiative transitions is performed, and the above approximations are found to be consistent with the results.

47903 **(IPPJ—662) Ion Bernstein wave heating experiment on JIPPT-II-U device.** Ono, M.; Watari, T.; Ando, R. (Nagoya Univ. (Japan). Inst. of Plasma Physics). Jan 1984. 17p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85702058.

Ion Bernstein wave heating is investigated in the JIPPT-II-U tokamak plasma, n-bar sub(o) asymptoticaly equals 1.5 x $10^{13}$ $cm^{-3}$, Tsub(eo) asymptoticaly equals 700 eV, and Tsub(io) = 300 eV for Psub(rf) $^{1}$– 100 kW. In a two-ion-species helium-hydrogen plasma, the third harmonics of helium minority cyclotron resonance (deuterium-like) is heated. The background hydrogen ion temperature monitored by charge-exchange shows a significant rise, ΔTsub(i) $^{1}$– 600 eV, when the helium harmonic resonance layer is placed near the center of the plasma. Typical observed hydrogen ion heating quality factor, ΔTsub(i)/Psub(rf) /n-barsub(o), is $^{1}$– 10 eV/kW/$10^{13}$$cm^{-3}$. The dependence of ion heating efficiency on rf power, magnetic field and ion concentration is presented.

47904 **(IPPJ—664) Classical picture of anomalous effects in a tokamak.** Hirano, K. (Nagoya Univ. (Japan). Inst. of Plasma Physics). Jan 1984. 14p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85702063.

It is demonstrated that the atomic collisions between plasma ions and a very small amount of neutral particles remaining in a hot plasma plays a very important role for plasma transports and may be an origin of anomalous effects observed in a tokamak such as the diffusion coefficient independent of the field strength, a rapid plasma density increase during gas puffing and current penetration with anomalously high speed in the start-up phase. The Ohm's law derived by Cowling is used for the analysis.

47905 **(IPPJ—665) External excitation of ion cyclotron drift waves in a two-ion species plasma.** Kando, M.; Ikezawa, S.; Sugai, H. (Nagoya Univ. (Japan). Inst. of Plasma Physics). Jan 1984. 13p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85702067.

Ion cyclotron drift waves propagating across a density gradient and a magnetic field have been excited externally in a two-ion species plasma, with its concentration ratio controlled. The measured dispersion relations agree with the theoretical predictions.

47906 **(IPPJ—666) Extraction of volume produced $H^-$ or $D^-$ ions from a sheet plasma, 2.** Uramoto, Joshin. (Nagoya Univ. (Japan). Inst. of Plasma Physics). Feb 1984. 33p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85702064.

A development to large area $H^-$ or $D^-$ ion source is tried by using three extraction electrodes: The first electrode bias voltage is set near the wall potential (floating), the second electrode is set near 13 % of main extraction voltage and the third electrode is the main acceleration electrode. An ion current of 13 mA (3.3 mA/$cm^2$) for $H^-$ or 11 mA (2.8 mA/ $cm^2$) for $D^-$ at 3 keV is extracted from 9 apertures of 6 mm phi in 4 $cm^2$ outside of the sheet plasma (14 cm wide and 1.0 cm thick) under a pressure of 7.7 x $10^{-4}$ H2 or D2 gas and a weak magnetic field 50 gauss. Then, it is noted that the corresponding electron current is suppressed below 1/10 of the $H^-$ or $D^-$ ion current.

47907 **(IPPJ—671) DC acceleration of charged particles by an electrostatic wave propagating obliquely to a magnetic field B-vector$_0$.** Sugihara, Ryo; Takeuchi, Satoshi; Sakai, Kazuo; Matsumoto, Michio. (Nagoya Univ. (Japan). Inst. of Plasma Physics). Mar 1984. 14p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85702068.

A charged particle trapped in an electrostatic wave is accelerated in the plane perpendicular to the wave vector K-vector. It is found that there is an optimum angle theta = theta sub(m) at which the particle gains a maximum energy which is about four times larger than that at theta = π/2, theta being K-vector, B-vector$_0$.

47908 **(IPPJ—673) Effect of trapped electrons on the beam-induced current, 2.** Taguchi, Masayoshi. (Nagoya Univ. (Japan). Inst. of Plasma Physics). Apr 1984. 22p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85702065.

The toroidal effect on the beam-induced current for an axisymmetric toroidal plasma is investigated by means of an expansion in √ epsilon (epsilon: inverse aspect ratio). A n expression for the induced current is obtained up to the order of epsilon. This current is numerically calculated when the beam ions are monoenergetic and the beam velocity is much smaller than the electron thermal velocity. By use of results, an approximate expression for the induced current is derived as a function of epsilon and effective charge Z-bar of the plasma.

47909 **(IPPJ-DT—114) Magnetic measurements for RFP experiment on STP-3(M).** Nagata, Akiyoshi; Tamaru, Takeshi; Arimoto, Hideki; Yamada, Shuichi; Sato, Koichi. (Nagoya Univ. (Japan). Inst. of Plasma Physics). Mar 1984. 41p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. File Number DE85702060.

Magnetic measurements are arranged for RFP experiment on STP-3(M). Magnetic measurements will be applied to investigate the discharge parameters, F(field reversal ratio) - theta(pinch parameter) diagram, the physical mechanism of flux enhancement and the toroidal and poloidal mode numbers due to the MHD instability. Theoretical considerations and instrumental techniques for magnetic measurements are described in detail.

47910 **(PPPL—2241) Start-up and ramp-up of the PLT tokamak by lower hybrid waves.** Jobes, F.C.; Bernabei, S.; Chu, T.K.; Fisch, N.J.; Hooke, W.M.; Karney, C.F.F.; Merservey, E.B.; Motley, R.W.; Stevens, J.E.; von Goeler, S. (Princeton Univ., NJ (USA). Plasma Physics Lab.). Aug 1985. Contract AC02-76CH03073. 32p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85017458.

Lower hybrid waves have been used on the PLT tokamak both to start the plasma current and to ramp it up from pre-existing levels. The waves, at 800 MHz, were launched from a 6-waveguide grill. The phasing between adjacent guides could be selected electronically, and thus the launched spectrum could be set and changed at will. For start-up, the waveguide phase difference was initially set at 0° in order to create a plasma, then switched to 90° to drive the current. Over 100 kA of plasma current, at a density of 0.5 to 1 x $10^{12}$ $cm^{-3}$, was generated in this manner. Ramp-up experiments were performed under a wide variety of conditions. The most efficient ramp-up was found at the lowest plasma densities and with the fastest launched spectrum (n/sub e/ ~ 2 x $10^{12}$ $cm^{-3}$, N/sub parallel/ ~ 1.6 peak); ~20% of the launched RF power was converted to (increased) poloidal field energy. All of the ramp-up results are in excellent agreement with a theory which determines the efficiency of ramp-up from the consideration of the relative energy losses of the superthermal current-carrying electrons to collisions and to the opposing inductive E-field.

47911 (RISO-R—517, pp 65-94) **Plasma physics.** Feb 1985. NTIS (US Sales Only), PC A05/MF A01. File Number DE85781588.

In Physics Department annual progress report 1 January-31 December 1984.

The plasma physics research in the Physics Department of Risoe National Laboratory is partly experimental and partly theoretical. A study of pellet-plasma interaction is applied nature and aimed at assessing the possibilities of refuelling a fusion reactor by shooting deuterium-tritium pellets into the plasma. A study of the fundamental physics of plasmas deals with investigations of wave propagation properties, instabilities, solitons, turbulence, etc.

47912 **(TRITA-PFU—84-07) Classical scaling laws of a Z-pinch with a cold-mantle.** Lehnert, B. (Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics and Fusion Research). May 1984. 22p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85702059.

Classical scaling laws are deduced for the equilibrium relations between pinch current J, pinch radius a, axial density $n_0$ and temperature $T_0$ of linear Z-pinches having a finite length L, as well as for toroidal Z-pinches having a large aspect ratio. In both cases the radius a is found to increase almost linearly with the current J at a fixed density $n_0$, and the temperature $T_0$ to increase with J at fixed values of the radius a. In principle, anomalous transport can be simulated in a first approximation by multiplying the transport coefficients by corresponding numerical factors. At a fixed density $n_0$ and a fixed external conductor current of an Extrap pinch, the radius a is found to increase more rapidly with J than the radius of the magnetic separatrix. Within the range of increasing pinch currents there are therefore three regimes of an Extrap system. For small J the system becomes unstable in the conventional way of unstabilized Z-pinches. For intermediate values of J, the magnetic surfaces become deformed by the external conductor field, and the constraints of this field combine with FLR and cold-mantle effects to provide a macroscopically stable state. Finally, for sufficiently large currents J, i.e. when the pinch radius a approaches and even tends to exceed the separatrix radius, the system is expected to become ballooning unstable in regions of -bad- field line curvature. The present analysis thus provides relations between the basic pinch parameters which can be tested by experiments, and it also contributes to the understanding of Extrap stability in terms of increasing pinch currents.

47913 **(TRITA-PFU—84-08) Density limits in Tokamaks.** Tendler M. (Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics and Fusion Research). Jun 1984. 15p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85702120.

The energy loss from a tokamak plasma due to neutral hydrogen radiation and recycling is of great importance for the energy balance at the periphery. It is shown that the requirement for thermal equilibrium implies a constraint on the maximum attainable edge density. The relation to other density limits is discussed. The average plasma density is shown to be a strong function of the refuelling deposition profile.

47914 **(TRITA-PFU—84-09) Holographic grating polychromator with optical fibre entrance and exits for laser scattering experiments.** Kuthy, A.; Lindau, S.; Tonks, J. (Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics and Fusion Research). Aug 1984. 15p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85702061.

A polychromator has been designed and constructed for the measurement of the electron temperature with high spatial resolution by Thomson scattering in the stabilized z-pinch EXTRAP. The design is centered on the use of low-loss silica single fibres of 0.4 mm core diameter. The dispersive element is an aberraion corrected concave holographic grating, specially designed to image the input fibre face onto the output fibre array with high efficiency. Very good stray light rejection is achived due to the grating being the single optical element in the polychromator.

47915 **(TRITA-PFU—84-10) Kinetic and macroscopic fluid descriptions of gases and plasmas.** Lehnert, B. (Royal Inst. of Tech., Stockholm (Sweden). Dept. of Plasma Physics and Fusion Research). Aug 1984. 27p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85702066.

A macroscopic fluid description of a neutral gas or a plasma requires internal -binding forces- to exist within the fluid. These forces prevent the individual particles from making large excursions by free-streaming, i.e. the particles should remain localized within macroscopically small elements of volume. A macroscopic fluid description of a collisionless plasma thus becomes incomplete or even erraneous with respect to the transverse directions of an immersed magnetic field, as soon as the ion Larmor radius is comparable to or larger than the characteristic macroscopic dimensions of the configuration to be considered. The resulting -large Larmor radius (LLR)- effect is kinetic and differs in its nature from the finite Larmor radius (FLR) effect earlier introduced by Rosenbluth et al. and being expressible in terms of a modified fluid model. The LLR effect is particularly important to high-beta plasmas in the interior of which there are zero points of the magnetic field strength. In certain cases this effect leads to strong collisionless -kinetic damping- of an imposed plasma disturbance, especially at small wave lengths. It is generally expected that several types of compressible, incompressible, electrostatic and electomagnetic plasma disturbances should become more or less affected by such damping.

47916 **(UCRL—92259) Implicit plasma simulation.** Langdon, A.B. (Lawrence Livermore National Lab., CA (USA)). 3 Mar 1985. Contract W-7405-ENG-48. 22p. (CONF-850266—8). NTIS, PC A02/MF A01; GPO Dep. File Number DE85016088.

From 2. international school for space simulation; Honolulu, HI, USA (3 Feb 1985).

Implicit time integration methods have been used extensively in numerical modelling of slowly varying phenomena in systems that also support rapid variation. Examples include diffusion, hydrodynamics and reaction kinetics. This article discussed implementation of implicit time integration in plasma codes of the "particle-in-cell" family, and the benefits to be gained.

47917 **Experiments on whistler mode electron-cyclotron resonance plasma startup and heating in an axisymmetric magnetic mirror.** Booske, J.H.; Getty, W.D.; Gilgenbach, R.M.; Jong, R.A. (College of Engineering, University of Michigan, Ann Arbor, Michigan 48109). *Physics of Fluids;* **28**: No. 10, 3116-3126(Oct 1985).

Whistler mode electron-cyclotron resonance heating (ECRH) has been performed simultaneously with whistler mode electron-cyclotron emission measurements on an axisymmetric magnetic mirror plasma. Results presented include a study of the early plasma startup phase and two instability phases, one believed to be caused by a whistler instability and another by magnetohydrodynamic (MHD) flute instability. Enhanced microwave emission at frequencies below the midplane electron-cyclotron frequency has been correlated with enhanced electron endloss during the whistler instability. Cyclotron emission spectra during the startup phase match predictions for a "sloshing electron" type distribution based on numerical modeling. This distribution also agrees with anisotropic distributions resulting from electron-cyclotron heating as predicted by Fokker—Planck computer simulations. Experimentally measured heating rates show good agreement with simplified analytical models based on stochastic heating.

47918 **Role of magnetic reconnection and differential rotation in spheromak formation.** Guzdar, P.N.; Finn, J.M.; Whang, K.W.; Bondeson, A. (Laboratory for Plasma and Fusion Energy Studies, University of Maryland, College Park, Maryland 20742). *Physics of Fluids;* **28**: No. 10, 3154-3166(Oct 1985).

The physical processes involved in the formation of a spheromak are studied. Using one-fluid axisymmetric resistive magnetohydrodynamic equations together with a temperature equation, investigations of the essential physics aspects of the formation specifically for the new Maryland Spheromak (MS) [J. Antoniades, C. Chin-Fatt, A. DeSilva, G. Goldenbaum, R. Hess, and R. Shaw, in Proceedings of the Sixth U. S. Symposium on Compact Torus Research, Princeton, 1984 (Princeton Plasma Physics Laboratory, Princeton, NJ, 1985), p. 65] have been performed. These studies elucidate the role of differential rotation in accelerating the penetration of toroidal field B/sub phi/ and in forcing Iequivalent rB/sub phi/ to be a flux function. Another important aspect of the formation is the magnetic reconnection that occurs at the X point between the two reversal coils. A strong toroidal current is generated by the reconnection, and the X point is converted into an O point that finally becomes the magnetic axis of the spheromak. In this latter phase of reconnection, the plasma is heated very strongly. Studies have also been done on the effect of the difference in phase and time scales for the reversal and I/sub z/ banks for the purpose of optimization.

47919 **Analysis of nonlinear mass and energy diffusion.** Rosenau, P.; Hyman, J.M. (Center for Nonlinear Studies, Theoretical Division, Mail Stop B284, Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Physical Review [Section] A: General Physics;* **32**: No. 4, 2370-2373(Oct 1985). Contract W-7405-ENG-36.

A study of nonlinear plasma mass and energy diffusion reveals that the diffusion coefficients uniquely determine one of two diffusion patterns. After a short initial transient time, either an organized universal pattern, described by a time-space separable solution, is formed or transport is inhibited, allowing only a partial organization of diffusion into a universal pattern. Consequently, in the second case, unlike the first, the asymptotic shape of the solution will depend to some extent on its initial state.

47920 **High-resolution measurement of electron velocity distribution functions in a plasma.** Maffei, K.C.; Griem, H.R. (Laboratory for Plasma and Fusion Energy Studies, University of Maryland, College Park, Maryland 20742). *Physics of Fluids;* **28**: No. 10, 3027-3033(Oct 1985).

A Thomson scattering diagnostic capable of achieving one-discharge, high-resolution spectra through use of a microchannel plate image intensifier coupled to an optical multichannel analyzer has been implemented on a theta-pinch device. The improved resolution permits measurements of local average electron velocities and current densities. First-order relativistic corrections and anomalous velocity-space fluctuations are directly observable. The enhanced fluctuations are attributed to electrons interacting with unstable waves.

47921 **Spectroscopic investigation of a reversed field pinch operated without limiters.** Weber, P.G. (Los Alamos National Laboratory, Los Alamos, New Mexico 87545). *Physics of Fluids;* **28**: No. 10, 3136-3141(Oct 1985).

Spectroscopic measurements on the ZT-40M reversed field pinch [submitted to Fusion Tech.] discharge are reported. Specifically, the impurity content, Z/sub eff/, recycling behavior, ion temperature, and propagation of magnetohydrodynamic modes in the edge are addressed. The importance of the plasma—wall interaction in ZT-40M, operated without limiters, is demonstrated.

47922 **Comparison of the theory and the practice of lower-hybrid current drive.** Karney, C.F.F.; Fisch, N.J.; Jobes, F.C. (Plasma Physics Laboratory, Princeton University, P.O. Box 451, Princeton, New Jersey 08544). *Physical Review [Section] A: General Physics;* **32**: No. 4, 2554-2556(Oct 1985).

The theory of rf-driven plasma currents is applied to the lower-hybrid experiments on the Princeton Large Torus, Princeton University, tokamak. Particular emphasis is placed on those experiments in which the plasma current was varying. The comparison between theory and experiment is made with respect to the efficiency with which rf energy was converted to poloidal magnetic field energy. Good agreement is found irrespective of whether the current was increasing, constant, or decreasing.

47923 **Nonlinear mode conversion and anomalous absorption processes during radio-frequency heating of bumpy torus plasmas.** Stefan, V.; Krall, N.A. (JAYCOR, P. O. Box 85154, San Diego, California 92138). *Physics of Fluids;* **28**: No. 10, 2937-2959(Oct 1985).

The theory of nonlinear mode conversion is reviewed and applied to the ELMO Bumpy Torus (EBT) [Proceedings of the 5th International Conference on Plasma Physics and Controlled Nuclear Fusion Research 1974 (IAEA, Vienna, 1975), Vol. 2, p. 141] environment in the electron-cyclotron, upper-hybrid, lower-hybrid, and ion-cyclotron frequency ranges. A variety of parametric excitations in these frequency ranges is studied. Based on cascade saturation mechanisms, the parametric turbulence levels and corresponding anomalous absorption rates of the excited modes are evaluated. The relevance of nonlinear mode conversion for contemporary and future EBT experiments is discussed.

47924 **Enhancement of the plasma potential by fluctuating electric fields near the ion cyclotron frequency.** Hershkowitz, N.; Nelson, B.A.; Johnson, J.; Ferron, J.R.; Persing, H.; Chan, C.; Golovato, S.N.; Callen, J.D.; Woo, J. (Nuclear Engineering Department, University of Wisconsin, Madison, Wisconsin 53706). *Physical Review Letters;* **55**: No. 9, 947-950(26 Aug 1985). Contract AC02-78ET51015.

It is found that ion cyclotron rf can create an ion plugging plasma potential equal to several times T/sub e//e(≈T/sub i//e) in the Phaedrus tandem mirror end cells or at the end of the central cell. A model based on a local balance of electron expulsion by the rf field E/sub z/ and trapping by Coulomb scattering predicts the magnitude and scaling of the potential with density and rf antenna current. This model is in reasonable agreement with experimental observations. This ion-cyclotron rf enhanced potential increases as the plasma density decreases and as the antenna current increases.

47925 **Numerical simulation of ion acoustic turbulence.** Lindman, E.L. (Los Alamos National Laboratory, Los Alamos, New Mexico). *Journal of Statistical Physics;* **39**: No. 3, 769-782(Jun 1985).

Extensive simulation studies of ion acoustic turbulence carried out at the Max Planck Institute and at the Los Alamos National Laboratory are compared. Simulations of the B = 0 case carried out at the two laboratories agree when the Sagdeev scaling law without the T/sub e//T/sub i/ dependence is used to compare them. Typical results are shown. The level of turbulence is found to be quite high in spite of the low anomalous collision frequency. The role of the "differential drift" distribution in these simulations is discussed extensively.

47926 **Stability of ion acoustic turbulent states.** DuBois, D.F.; Pesme, D. (Theoretical Division, Los Alamos National Laboratory, Los Alamos, New Mexico). *Journal of Statistical Physics;* 39: No. 3, 783-816(Jun 1985).

Several proposed renormalized theories for "strong" ion acoustic turbulence are compared to the direct interaction approximation. These are applied to the calculation of the stability of ion acoustic turbulent states to the excitation of Langmuir waves. A kinetic instability proposed by Tsytovich, Stenflo, and Wihelmsson is shown to be stabilized by resonant and nonresonant decay processes. The global kinetic stability of the Langmuir spectrum is enhanced through the coupling of opposite phase velocity Langmuir waves by the decay processes and by nonresonant scattering to regions of strong Landau damping.

47927 **Electron-cyclotron resonance heating in tandem mirrors.** Lam, N.T.; Audenaerde, K.R.; Scharer, J.E. (Department of Electrical and Computer Engineering, University of Wisconsin, Madison, WI 53706). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Plasma Science;* PS-13: No. 1, 25-36(Feb 1985).

Using numerical ray-tracing techniques, we study the propagation and absorption profiles of electromagnetic waves launched in the end cells of three different tandem mirrors: Phaedrus, an overdense low-temperature tandem mirror with plugs; TASKA, a conceptual tandem mirror with plugs and thermal barrier; and TMX-U, a tandem mirror with a significant hot-electron population. In particular, the effects of weakly relativistic thermal anisotropy on the absorption profile are examined. In general, at sufficiently low densities and temperatures, the X mode can access the plasma and achieve significant heating of the electrons. As the electron temperature increases, the X mode gets quickly absorbed at the edge and only the O mode achieves significant penetration and heating. For sufficiently large launching angles, the presence of thermal anisotropy can actually shift the region of maximum absorption towards the electron-cyclotron resonance layer. Regions of whistler instability appear along rays launched nearly along the machine axis, when the thermal-anisotropy ratio, temperature, and density reach sufficiently high values.

47928 **Determination of spatial distribution of plasma electrons by multibeam FIR interferometry.** Demas, N.G.; Hutchinson, D.P.; Ma, C.M.; Staats, P.A. (Tennessee Technological University Cookeville, TN 38501). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Plasma Science;* PS-13: No. 1, 41-44(Feb 1985).

The spatial distribution of plasma electrons in the ISX-B Tokamak has been determined by Abel-inverting vertical integral data from far infrared (FIR) laser-phase shift measurements. The calculational method for performing the Abel inversion is discussed and the results of the inversion of several sets of data are compared with Thomson scattering measurements of the pointwise electron density, and with the 2-mm interferometer measurement of the horizontal-midplane lineintegral electron density. The inversion method used is essentially that described by Demas et al. This method is an extension of the method described by Yasutomo et al. The main difference is that the inversion method used here can treat plasmas with any outer boundary shape as long as the radius of the surface is single valued. In this regard it is more general than the inversion method of Wetzer, which is restricted to using an elliptical outer-plasma boundary.

47929 **A force-balance scaling for charged particle beam current.** Kadish, A. (Los Alamos Nationai Laboratory, Los Alamos, NM 87545). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Plasma Science;* PS-13: No. 1, 2-5(Feb 1985).

A limiting current for cold, relativistic, charged particle beams is derived. Arbitrary rotation and axial flow profiles are allowed. Only force balance is required. A comparison with the usual Brillouin condition reveals a significantly more restrictive scaling for ambitious beam parameters.

47930 **Relativistic derivation of the ponderomotive force produced by two intense laser fields.** Stroscio, M.A. (Office of Inertial Fusion, U.S. Department of Energy, Washington, DC 20545). *IEEE (Institute of Electrical and Electronics Engineers) Transactions on Plasma Science;* PS-13: No. 1, 16-18(Feb 1985).

The ponderomotive force plays a fundamental role in the absorption of laser light on self-consistent plasma density profiles, in multiple-photon ionization, and in intense field electrodynamics. The relativistic corrections to the ponderomotive force of a transversely polarized electromagnetic wave lead to an approximately 20-percent reduction in the single particle ponderomotive force produced by a 10-$\mu$m $10^{16}$-W/cm$^2$ laser field. Recent experimental investigations are based on using two intense laser fields to produce desired lasermatter interactions. This paper presents the first derivation of the nonlinear relativistic ponderomotive force produced by two intense laser fields. The results demonstrate that relativistic ponderomotive forces are not additive.

47931 **(PPPL-TRANS—129) Fast neutron activating detectors for pulsed flow measurements.** Dyatlov, V.D.; Kunaev, G.T.; Popytaev, A.N.; Cheremukhov, B.V. (Princeton Univ., NJ (USA). Plasma Physics Lab.; Nauchno-Issledovatel'skij Inst. Ehlektrofizicheskoj Apparatury, Leningrad (USSR)). Jan 1979. Contract AC02-76CH03073. Translation of Preprint K-0336. 42p. NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85017017.

The requirements to the activation detectors of the pulsed flows of the fast neutrons are considered; the criteria of optimum measurement time, geometrical moderator sizes and radioactive detector element properties have been obtained. On their analysis parameter selection has been carried out. The neutron detector to register the short pulses has been designed and calibrated. The ways of further increase of sensitivity and efficiency of such detectors are discussed.

## 7002 Fusion Power Plant Technology

*REFER ALSO TO CITATION(S) 46761, 47022, 47249, 47858*

47932 **(CONF-8505175—5) Modular tokamak power plant.** Dabiri, A.E.; Keeton, D.C. (Oak Ridge National Lab., TN (USA)). 1985. Contract AC05-84OR21400. 9p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85017308.

From TPSS meeting; Atlanta, GA, USA (15 May 1985).
Viewgraphs from this meeting are presented. (MOW)

47933 **(CONF-8508110—1) Effect of beta limits on tokamak economics.** Thomson, S.L. (Oak Ridge National Lab., TN (USA)). 1985. Contract AC05-84OR21400. 12p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85017314.

From TPSS review meeting; Boston, MA, USA (12 Aug 1985).

Viewgraphs from the meeting are included. (MOW)

47934 **(F—82008) Health, safety and environmental research program.** Dinner, P.J. (Canadian Fusion Fuels Technology Project, Toronto, Ontario). Jan 1983. 31p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85702077.

This report outlines the Health, Safety and Environmental Research Program being undertaken by the CFFTP. The Program objectives, relationship to other CFFTP programs, implementation plans and expected outputs are stated. Opportunities to build upon the knowledge and experience gained in safely managing tritium in the CANDU program, by addressing generic questions pertinent to tritium safety for fusion facilities, are identified. These opportunities exist across a broad spectrum of issues covering the anticipated behaviour of tritium in fusion facilities, the surrounding environment and in man.

47935 **(F—83010) Database for fusion devices and associated fuel systems.** Woolgar, P.W. (Canadian Fusion Fuels Technology Project, Toronto, Ontario). Mar 1983. 50p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85702069.

A computerized database storage and retrieval system has been set up for fusion devices and the associated fusion fuel systems which should be a useful tool for the CFFTP program and other users. The features of the Wang 'Alliance' system are discussed for this application, as well as some of the limitations of the system. Recommendations are made on the operation, upkeep and further development that should take place to implement and maintain the system.

47936 **(F—83011) TSOAK-M1: an examination of its model and methods.** Edgell, D.H. (Canadian Fusion Fuels Technology Project, Toronto, Ontario). May 1983. 33p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85702114.

Fusion facilities will contain a sizable inventory of tritium fuel that will be vulnerable to release. Once released, molecular tritium begins converting into tritiated water which is 10000 times more hazardous and tends to adsorb onto surfaces. The rate of conversion and adsorption/desorption must be accurately known to estimate cleanup times and radiation hazards realistically. Argonne National Laboratory developed a computer code, TSOAK-M1, to determine the conversion/ adsorption/desorption parameters and to model cleanups. The Canadian Fusion Fuels Technology Project examined the program for reliability and potential applications. TSOAK-M1 assumes a pseudo second order radiolytic conversion where a first order surface reaction seems more appropriate. This difference in order should be investigated to accurately determine the reaction law. TSOAK-M1 determines the model parameters from experimental data using an optimization routine. However the data used is judged insufficient. More data is needed where the conversion of molecular tritium to tritiated water has a significant effect due to adsorption/desorption. SOAKER, an improved version of the TSOAK-M1 model, which combines first and second order reactions has been implemented in Wang BASIC. Once the reaction law and the parameters have been accurately determined the program could be a useful tool in the study and design of decontamination systems.

47937 **(F—83018) Design assessment of tritium removal systems for the mirror advanced reactor study.** Sood, S.K.; Kveton, O.K. (Canadian Fusion Fuels Technology Project, Toronto, Ontario). 4 Oct 1983. 32p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85702075.

This study investigates the available processes for removing tritium from light water, and selects the most appropriate process for recovering tritium from the various tritiated water streams identified in the Mirror Advanced Reactor Study (MARS). A simplified flowsheet is shown for the process and the main process parameters are identified. Previous experience is utilized to predict direct capital costs and power requirement for the Tritiated Water Removal Unit (TWRU). A number of possibilities are discussed for lowering the cost of the TWRU. An estimate is made of the direct capital cost for the Air Detritiation System that has already been selected as the reference design by MARS personnel. The leakage from the MARS coolant loop is estimated, based on the experience obtained with Ontario Hydro's coolant systems. Design targets are identified for tritium levels in the reactor hall atmosphere and in water and air emissions. Tritium levels are predicted for these and are assessed against the previously identified targets.

47938 **(F—84022) Helium-3 induced enhancement of tritium production for fusion reactors.** Thomas, G.F. (Canadian Fusion Fuels Technology Project, Toronto, Ontario). Nov 1983. 62p. NTIS (US Sales Only), PC A04/MF A01. File Number DE85702078.

This report provides the results of an inquiry into the feasibility of enhancing tritium production levels through the activation of helium-3 following its external addition to the moderator system of a CANDU reactor. The physical basis for the scheme lies in the fact that the cross section for the activation of helium-3 to tritium is several orders of magnitude larger than the cross section for deuterium activation. The imminent introduction of a centralized facility for the removal, immobilization, and storage of tritium ensures a supply of helium-3, the product of tritium decay.

47939 **(F—84025) Health physics in fusion reactor design. The application of CANDU experience with tritium.** Wong, K.Y.; Dinner, P.J.; Vivian, G.A. (Canadian Fusion Fuels Technology Project, Toronto, Ontario). Jun 1984. 45p. (CONF-840512—20). NTIS (US Sales Only), PC A03/MF A01. File Number DE85702070.

From 6. congress of the International Radiation Protection Association; Berlin, F.R. Germany (7 May 1984).

Experience in the control of tritium exposures to workers and the public gained through the design and operation of Ontario Hydro's nuclear stations has been applied to fusion projects and to design studies on emerging fusion reactor concepts. Ontario Hydro performance in occupational tritium exposure control and environmental impact is reviewed. Application of tritium control technologies and dose management methodology during facility design is highlighted.

47940 **(F—84026) Adsorption of moisture on molecular sieve adsorbents at low humidity.** Singh, V.P.; Ruthven, D.M. (Canadian Fusion Fuels Technology Project, Toronto, Ontario). Jul 1984. 50p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85702079.

This report summarizes the results and conclusions of a contractor's study on the performance of 4A molecular sieve under very low humidity conditions, e.g., as expected in fusion reactor plants. The results suggest that: (a) very efficient regeneration of the sieve to low residual moisture contents (<approximately 2 g/ 100 g sieve) is necessary to ensure adequate performance with exit dew points of -60 degrees C or less; (b) based on equilibrium data, there is no significant isotopic effect at water vapor concentrations above about 100 μL/L i.e., molecular sieve driers for this condition can be designed for the adsorption of DTO/HTO using easily obtainable data for the $H_2O$/4A sieve system.

47941 **(F—84027) Review of tritium conversion reactions.** Robins, J.R.; Bartoszek, F.E.; Woodall, K.B. (Canadian Fusion Fuels Technology Project, Toronto, Ontario). 27 Jun 1984. 71p. NTIS (US Sales Only), PC A04/MF A01. File Number DE85702080.

The chemical processes by which elemental tritium can be converted to tritiated water have been examined by reviewing the available literature on these processes. It would appear that gas phase conversion reactions at room temperature are slow and that they do not contribute significantly to any observed conversion following releases of elemental tritium. The effects of surfaces are not clearly understood. Metals, however, can increase the rate over the gas phase processes, but the magnitude of this increase is not well documented. Further work is necessary to examine the effects of various materials, elevated temperatures, and other parameters on conversion reactions in order to more closely reflect conditions in reactor buildings and other tritium containing facilities.

47942 **(F—84029) Review of compact, alternate concepts for magnetic confinement fusion.** Nickerson, S.B.; Shmayda, W.T.; Dinner, P.J.; Gierszewski, P.; Deksnis, E.B. (Canadian Fusion Fuels Technology Project, Toronto, Ontario). Jun 1984. 197p. NTIS (US Sales Only), PC A09/MF A01. File Number DE85702074.

This report documents a study of compact alternate magnetic confinement fusion experiments and conceptual reactor designs. The purpose of this study is to identify those devices with a potential to burn tritium in the near future. The bulk of the report is made up of a review of the following compact alternates: compact toroids, high power density tokamaks, linear magnetic systems, compact mirrors, reversed field pinches and some miscellaneous concepts. Bumpy toruses and stellarators were initially reviewed but were not pursued since no compact variations were found. Several of the concepts show promise of either burning tritium or evolving into tritium burning devices by the early 1990's: RIGGATRON, Ignitor, OHTE, Frascati Tokamak upgrade, several driven (low or negative net power) mirror experiments and several Re-

versed Field Pinch experiments that may begin operation around 1990. Of the above only the Frascati Tokamak Upgrade has had funds allocated. Also identified in this report are groups who may have tritium burning experiments in the mid to late 1990's. There is a discussion of the differences between the reviewed devices and the mainline tokamak experiments. This discussion forms the basis of recommendations for R and D aimed at the compact alternates and the applicability of the present CFFTP program to the needs of the compact alternates. These recommendations will be presented in a subsequent report.

47943 **(F—84032) Simulation and optimization for the measurement of tritium profiles in solids.** Wan, P.T.; Thompson, D.A.; Caterini, M. (Canadian Fusion Fuels Technology Project, Toronto, Ontario). Jul 1984. 71p. NTIS (US Sales Only), PC A04/MF A01. File Number DE85702073.

The present report is the culmination of a three-month study by computer simulation and optimization of an experimental technique for profiling tritium in the near-surface region of solids using the $^{3}T(d,^{4}He)n$ reaction. The present study serves as a prelude to a detailed experimental investigation to be carried out at McMaster University on the migration of tritium in metals and other solids subjected to high temperatures, temperature gradients and radiation damage.

47944 (INIS-SU—301, pp 36-47) **Nuclear fusion and neutron processes.** Orlov, V.V.; Shatalov, G.E.; Sherstnev, K.E. (Inst. Atomnoj Ehnergii, Moscow, USSR). 1984. (In Russian). NTIS (US Sales Only), PC A18/MF A01. File Number DE85781590. (CONF-8310228—Vol.1).

From 6. Soviet national conference on neutron physics; Kiev, USSR (10 Oct 1983).

Problems of development of the design of an experimental fusion reactor with necessary neutron-physical data are discussed. Isotope composition of spent fuel in the blanket of a hybride fusion reactor (HFR) is given. Neutron balance of the reactor with Li-blanket and neutron balance of the reactor with Pb-multiplier are disclosed. A simplified scheme of neutron and energy balance in the HFR blanket is given. Development and construction of the experimental power reactor is shown to become the nearest problem of the UTS program. Alongside with other complex physical and technical problems solution of this problem requires realization of a wide program of neutron-physical investigations including measurements with required accuracy of neutron cross sections, development of methodical, program and constant basis of neutron calculations and macroscopic experiments on neutron sources.

47945 **(INS-NUMA—55) Some remarks on the design of HIF current multiplication rings.** Reich, K.H. (Tokyo Univ., Tanashi (Japan). Inst. for Nuclear Study). Dec 1983. 21p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85702076.

The conceptual design of heavy ion fusion drivers has now reached a state, where the overall approach has become fairly clear. One design features an RF linac plus current and beam multiplication rings. The present remarks concern the assignment of multiturn injection, beam storage and bunching to an optimized number of rings and transport lines, as well as some criteria for their designs. The main parameter constraints are discussed, showing how they can be met, although there is little flexibility at the present stage of understanding and technology. A shortened version of this report is scheduled for presentation at the "INS International Symposium on Heavy Ion Accelerators and Their Application to Inertial Fusion" Tokyo, January 23-27 1984.

47946 **(IPPJ—659) Conceptual design of the RFC reactor.** Kumazawa, R.; Adati, K.; Hatori, T.; Ichimura, M.; Obayashi, H.; Okamura, S.; Sato, T.; Watari, T.; Emmert, G.A. (Nagoya Univ. (Japan). Inst. of Plasma Physics). Dec 1983. 23p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85702057.

A parametric analysis and a preliminary conceptual design for the RFC reactor (including cusp field) with and without alpha particle heating are described. Steady state operation can be obtained for various RF ponderomotive potentials in the case of alpha particle heating.

47947 **(IPPJ—660) Moving ring reactor 'Karin-1'. Conceptual design of moving ring reactor.** (Nagoya Univ. (Japan). Inst. of Plasma Physics). Dec 1983. 481p. NTIS (US Sales Only), PC A21/MF A01. File Number DE85702071.

The conceptual design of a moving ring reactor "Karin-1" has been carried out to advance fusion system design, to clarify the research and development problems, and to decide their priority. In order to attain these objectives, a D-T reactor with tritium breeding blanket is designed, a commercial reactor with net power output of 500 MWe is designed, the compatibility of plasma physics with fusion engineering is demonstrated, and some other guideline is indicated. A moving ring reactor is composed mainly of three parts. In the first formation section, a plasma ring is formed and heated up to ignition temperature. The plasma ring of compact torus is transported from the formation section through the next burning section to generate fusion power. Then the plasma ring moves into the last recovery section, and the energy and particles of the plasma ring are recovered. The outline of a moving ring reactor "Karin-1" is described. As a candidate material for the first wall, SiC was adopted to reduce the MHD effect and to minimize the interaction with neutrons and charged particles. The thin metal lining was applied to the SiC surface to solve the problem of the compatibility with lithium blanket. Plasma physics, the engineering aspect and the items of research and development are described.

47948 **(JAERI-M—84-072) Wall heat flux from radiative heat sources distributed in a toroidal space.** Ando, Toshiro; Watanabe, Yoichi. (Japan Atomic Energy Research Inst., Tokyo). Apr 1984. 106p. (In Japanese). NTIS (US Sales Only), PC A06/MF A01. File Number DE85702232.

A calculation method of wall heat flux from radiative heat sources distributed in a toroidal space is presented. The first walls are modeled by a continuous surface with uniformity in the toroidal direction. It is assumed that radiative heat sources are distributed within the poloidal cross section, while have an uniform distribution in the toroidal direction. The model wall surface and radiative area have symmetry with respect to the horizontal mid-plane of the torus. It is also assumed that radiation is emitted isotropically and transferred without absorption in the space, and then absorbed on the first walls without reflection. Based on these assumptions, the general description for the radiative heat flux is derived. For the numerical calculation, an idea of "light path cross section" is introduced to deal with the torus having a complicated poloidal cross section such as JT-60. Finally, results of the computation are demonstrated for the JT-60 "high compression case" where a strong radiative remote cooling occurs in the magnetic limiter chamber.

47949 **(LBL—19601) Developments in accelerators for heavy ion fusion.** Keefe, D. (Lawrence Berkeley Lab., CA (USA)). May 1985. Contract AC03-76SF00098. 8p. (CONF-850504—278). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85017645.

From Particle accelerator conference; Vancouver, Canada (13 May 1985).

The long term goal of Heavy Ion Fusion (HIF) is the development of an accelerator with the large beam power, large beam stored-energy, and high brightness needed to implode small deuterium-tritium capsules for fusion power. While studies of an rf linac/storage ring combination as an inertial fusion driver continue in Japan and Europe, the US program in recent times has concentrated on the study of the suitability of linear induction acceleration of ions for this purpose. Novel features required include use of multiple beams, beam current amplification in the linac, and manipulation of long beam bunches with a large velocity difference between head and tail. Recent experiments with an intense bright beam of cesium ions have established that much higher currents can be transported in a long quadrupole system than was believed possible a few years ago. A proof-of-principle ion induction linac to demonstrate beam current amplification with multiple beams is at present being fabricated at LBL. 28 refs., 4 figs.

47950 **(RISO-M—2482) Computer modelling of radioactive source terms at a tokamak reactor.** Meide, A. (Risoe National Lab., Roskilde (Denmark)). Dec 1984. 14p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85702072.

The Monte Carlo code MCNP has been used to create a simple three-dimensional mathematical model representing 1/12 of a tokamak fusion reactor for studies of the exposure rate level from neutrons as well as gamma rays from the activated materials, and for later estimates of the consequences to the environment, public, and operating personnel. The model is based on the recommendations from the NET/INTOR workshops.

47951 **(SAND—85-1775C) Development of a photonic data recorder.** Davis, H.P.; Allen, G.R.; Chang, J. (Sandia National Labs., Albuquerque, NM (USA)). 1985. Contract AC04-76DP00789. 6p. (CONF-850887—21). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85017120.

From SPIE international technical symposium on optical and electro-optical engineers; San Diego, CA, USA (18 Aug 1985).

In conjunction with our implementation of photonic diagnostics on pulsed power accelerators at Sandia, we are developing a Photonic Data Recorder (PDR) which sweeps and records photon analog signals directly rather than converting photons to electrons and sweeping the electrons, as in a conventional oscilloscope or streak camera.

47952 **(UCRL—15700-Vol.2) Mirror Fusion Test Facility-B (MFTF-B) axicell configuration: NbTi magnet system. Manufacturing/producibility final report. Volume 2.** Ritschel, A.J.; White, W.L. (General Dynamics Corp., San Diego, CA (USA). Convair Div.). May 1985. Contract W-7405-ENG-48. 226p. NTIS, PC A11/MF A01; 1; GPO Dep. File Number DE85017284.

This Final MFTF-B Manufacturing/Producibility Report covers facilities, tooling plan, manufacturing sequence, schedule and performance, producibility, and lessons learned for the solenoid, axicell, and transition coils, as well as a deactivation plan, conclusions, references, and appendices.

47953 **Production of solid $D_2$ threads for dense Z-pinch plasmas.** Grilly, E.R.; Hammel, J.E.; Rodriguez, D.J.; Scudder, D.W.; Shlachter, J.S. (Los Alamos National Laboratory, P. O. Box 1663, Los Alamos, New Mexico 87545). *Review of Scientific Instruments;* **56**: No. 10, 1885-1887(Oct 1985).

A liquid-He/liquid-$N_2$ cryostat system has been developed to freeze $D_2$ gas and extrude fibers of solid deuterium into a vacuum chamber. Fibers that are 40 μm in diameter and 10 cm long have been successfully and routinely produced. The fibers are observed to remain constant in physical dimensions for several minutes. A fiber will be used as the electrical load for a pulsed power machine in a program investigating the properties of dense, ohmically heated plasmas for controlled thermonuclear fusion.

47954 **Gas flow measurements of a novel geometry for neutral beam neutralizers.** Pirkle, D.R.; Conrad, J.R. (Nuclear Engineering Department, University of Wisconsin, Madison, Wisconsin 53706). *Journal of Vacuum Science and Technology, A: Vacuum, Surfaces, and Films;* **3**: No. 5, 2018-2027(Sep 1985).

The conductance and line density of a novel geometry (pumped geometry) for neutral beam neutralizers were measured and compared with a conventional (passive) neutralizer geometry in the transition flow regime. A passive neutralizer geometry is merely a duct attached to the ion source. For the pumped geometry, the top and bottom surfaces of the duct are replaced by a venetian blind geometry which opens into ballast vacuum pumping volumes. A one-half scale model with pumped neutralizer geometry was built and compared with a passive neutralizer geometry of comparable dimensions. A gas source was maintained at fixed pressure and the conductance and line density of the two geometries were measured. These measurements were repeated for several values of gas source pressure, covering the range of pressures typically used in neutral beam ion sources. With the vanes on the pumped neutralizer geometry opened to 55 deg and the gas source pressure "low," i.e., in the range of pressures typical for "bucket-type" magnetic field ion sources, the amount of gas flowing from the exit of the pumped geometry was about 3 times less than the amount flowing from the passive geometry. As the source gas pressure was increased, the ratio of gas flow from the exit of the passive geometry to that of the pumped geometry increased also. At gas source pressures typical of magnetic field free ion sources, up to 5 times less gas flowed from the pumped geometry. On the other hand, the neutral gas line density of the pumped geometry was only 1.6 times less than that of the passive geometry, independent of the source gas pressure.

47955 **Low activation ferritic alloys.** Gelles, D.S.; Ghoniem, N.M.; Powell, R.W. (to Dept. of Energy). US Patent Application 6-699,092. 7 Feb 1985. 20p. Contract AC06-76FF02170. DE85017795 NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85017795.

Low activation ferritic alloys, specifically bainitic and martensitic stainless steels, are described for use in the production of structural components for nuclear fusion reactors. They are designed specifically to achieve low activation characteristics suitable for efficient waste disposal. The alloys essentially exclude molybdenum, nickel, nitrogen and niobium. Strength is achieved by substituting vanadium, tungsten, and/or tantalum in place of the usual molybdenum content in such alloys.

47956 **Large-aperture optical-switching devices.** Goldhar, J.; Henesian, M.A. (Lawrence Livermore National Lab., CA). *Proceedings of the Society of Photo-Optical Instrumentation Engineers;* **464**: 64-72(1984). (CONF-840139—). Contract W-7405-ENG-48.

From SPIE technical symposium and instrument exhibit; Los Angeles, CA, USA (22 Jan 1984).

A new approach to constructing large aperture optical switches for next-generation inertial-confinement fusion lasers was developed. A transparent plasma electrode formed in low-pressure ionized gas acts as a conductive coating to allow the uniform charging of the optical faces of an electro-optic material. In this manner large electric fields can be applied longitudinally to large-aperture, high-aspect-ratio Pockels cells. A four-electrode geometry was proposed to create the necessary high-conductivity plasma sheets, and fast (<10 nsec) switching in a 5 x 5 cm aperture KD*P Pockels cell with such a design was demonstrated. Detailed modeling of Pockels-cell performance with plasma electrodes was carried out for 15- and 30-cm aperture designs. 10 references, 8 figures, 2 tables.

# 99 GENERAL AND MISCELLANEOUS

47957 **(CONF-8504134—2) Simulation of trip chaining potential in urban land use patterns.** Southworth, F. (Oak Ridge National Lab., TN (USA)). 1985. Contract AC05-84OR21400. 6p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85013225.

From 26. Instrument Society of America modeling and simulation conference; Pittsburgh, PA, USA (25 Apr 1985).

An operational trip chain building simulation model is described which allows computation of a variety of chain-based mixed land use accessibility indices. The chains built by the model can be used to generate trip chain sets for input to chain-based spatial interaction models. Two approaches to interaction modeling are described: the "nested logit" approach and an approach based upon separate calibration phases for the chain-based costs and benefits of interaction.

47958 **(DOE/ER—0042/3-Rev.8-85) Instruction and information on used energy-related laboratory equipment grants for educational institutions of higher learning. Revision.** (USDOE Office of Energy Research, Washington, DC. University and Industry Programs Div.). Aug 1985. 13p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85017457.

The United States Department of Energy (DOE), in accordance with its responsibility to encourage research and development in the energy area, awards grants of used energy-related laboratory equipment to universities and colleges and other non-profit educa-

tional institutions of higher learning in the United States for use in energy-oriented educational programs in the life, physical and environmental sciences and engineering. Proposals for the grant of available equipment in this program should be submitted by an eligible non-profit educational institution to the DOE Field Office responsible for the site where the specific equipment is known to be located.

47959 **(DOE/MA—0062/3) FY 1986 budget highlights.** (USDOE Assistant Secretary for Management and Administration, Washington, DC. Office of the Controller). Feb 1985. 57p. NTIS, PC A04/MF A01; GPO Dep. File Number DE85012772.

The FY 1986 budget request for DOE supports the energy, general science and defense missions of the Department in a comprehensive manner, while being responsive to the President's directive to all Federal agencies to freeze or reduce Government spending wherever possible to reduce the Federal deficit. The discussion displays the budget in a format designed to emphasize the varied activities of DOE. "Research and Development" describes the nature of the scientific and technical effort which underlies the Department's programs in a number of areas, such as energy, general science, and weapons research, which previously appeared in three distinct sections of our budget presentation. "Defense Production and Support" highlights a significant element of our defense activities which have production, whether of weapons or materials, as a common thread. "Waste Activities" combines programs from the civilian and defense areas to bring attention to a major effort of DOE "Business Enterprises" focuses attention on the fact that a number of the Department's activities are operated like businesses, marketing products and generating revenues. "Grants and Other Energy Functions" is how we group non-research and development grant programs and such essential activities as energy information and regulation. Finally, "Department Management" includes the various "overhead" organizations which keep the Department functioning at headquarters and in the field.

47960 **(DOE/MA—0083/1) Handbook for preparation of individual procurement action report (IPAR).** (USDOE Assistant Secretary for Management and Administration, Washington, DC. Procurement and Assistance Management Directorate). Aug 1985. 77p. NTIS, PC A05/MF A01; GPO Dep. File Number DE85017335.

The Procurement and Assistance Data System (PADS) provides a mechanism for collecting, assembling, organizing, and presenting contract data for the Department of Energy (DOE). This guide and associated documents establish a uniform system to report acquisition data to PADS, for collection, processing, and dissemination of official statistical data on the Department's procurement and assistance actions. The data provides, based on information available in the system at the time of request, a basis for any required recurring and special reports to the procurement executive, Congress, GAO, Federal executive agencies, OMB, and the general public. It provides data for measuring and assessing the extent to which small business firms and small minority business enterprises are sharing in DOE placement, and for other procurement policy and management control purposes.

47961 **(DOE/MI/10027—T1) Technical assistance and capability evaluation for the Historically Black Colleges and Universities. Final report.** Dobbins, C.J. (comp.). (Space Qualified Systems Ltd., Washington, DC (USA)). 19 Feb 1985. Contract AC01-83MI10027. 108p. NTIS, PC A06/MF A01; 1; GPO Dep. File Number DE85011240.

US DOE contracted with Space Qualified Systems to provide technical and management assistance to the Historically Black Colleges and Universities (HBCUs) through three tasks: technical assistance, HBCU-capability evaluation, and management assistance. This report summarizes the approach taken, lessons learned, results realized, and gives the recommendations. (DLC)

47962 **Asymptotic evaluation of high-frequency fields near a caustic: an introduction to Maslov's method.** Ziolkowski, R.W.; Deschamps, G.A. (Lawrence Livermore National Lab., CA). *Radio Science;* **19**: No. 4, 1001-1025(Jul-Aug 1984). Contract W-7405-ENG-48.

It is well known that the geometrical optics approximation, generally valid for high-frequency fields, fails in the vicinity of a caustic. A systematic procedure of V. P. Maslov that remedies this situation is reviewed. Maslov's method makes use of a representation of the geometrical optics field in the phase space M = X x K, where a point m = (Kappa, Kappa) is a pair of a position vector Kappa $\epsilon$ Chi and a wave vector kappa $\epsilon$ K. A Lagrangian submanifold of M, $\Lambda$, that lies in the dispersion surface and is a union of the phase space trajectories selected by the initial conditions is constructed. It can be considered as a global representation of the phase. The phase space amplitudes (half densities) satisfy transport equations defined along those trajectories in $\Lambda$. Since trajectories in M never form a caustic, a globally defined amplitude can be established on $\Lambda$. The field on X is related to the resultant field on $\Lambda$ by the canonical operator, an operator introduced by Maslov. It generates an integral form of the solution near a caustic that can be evaluated analytically, numerically, or with uniform symptotic techniques. Away from the caustic it recovers the geometrical optics field. Alternatively, the phase space field can be projected on a hybrid space Y where some of the space coordinates have been replaced by the corresponding wave vector components. For any caustic point in X, one such hybrid space Y where this projection does not encounter a caustic exists. A geometrical optics field results in Y that is related to the original in X by an asymptotic Fourier transform. The solution in X near a caustic can be represented as the Fourier transform to X of that hybrid space geometrical optics solution. These techniques are illustrated.

## 9901 Management

47963 **(BLG—565-Rev.1) Sample size required to be sure that an increase of percent defectives by a factor F will be labelled "significant" in 90% of the cases (+ corresponding critical values). Revision 1.** van der Parren, J.L. (Centre d'Etude de l'Energie Nucleaire, Brussels (Belgium). Studiecentrum voor Kernenergie). May 1985. 20p. NTIS (US Sales Only), PC A02/MF A01. File Number DE85901914.

A large reference sample of standardly produced items is available. A new production system is suspected of increasing the proportion of defectives. How much new material do we need to assess an increase by a factor F of the latter with confidence (1 - $\alpha$) and power (1 - $\beta$). Comparisons are done using hypergeometric distribution. Tables are given for F = to 12, $\alpha$ x .05, $\beta$ = .10 and proportions in the reference sample P1 = .001, .005, .010, .015, .020.

47964 **(K/CSD/INF—85/8) Managing environmental projects with the aid of computers.** Arrowood, L.F. (Oak Ridge Gaseous Diffusion Plant, TN (USA)). 1985. Contract AC05-84OT21400. 7p. (CONF-8509135—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85016304.

From 1022/1032 users conference; Boston, MA, USA (22 Sep 1985).

Computer programs have been implemented for the Health, Safety, Environment, and Accountability Division at the Y-12 Plant to assist managers in tracking project milestones and reporting progress on environmental activities throughout the facility. By invoking external graphics software routines within FORTRAN programs, users can generate schedule milestone charts which use information retrieved from databases. In addition to its graphics capabilities, this database management system provides many reports which identify those milestones due for completion within a specific time period; these can be broken down further by the responsible project manager or government agency. The increasing use of such integrated systems can be seen as further evidence of the efficiency of the computer as a management tool.

47965 **(LA—10497-T) Jobs, work-related values, and attitudes of staff and technicians at a national laboratory.** Meyer, M.A. (Los Alamos National Lab., NM (USA)). Jul 1985. Contract W-7405-ENG-36. 191p. NTIS, PC A09/MF A01; 1; GPO Dep. File Number DE85017952.

How do we explain differences in values and attitudes toward work between employees in structurally different job categories. To answer this question, research was conducted at a na-

tional laboratory where stereotypes predicted that Staff scientists and Technicians possess different job values and attitudes toward work. Data were obtained on the employees' perceptions of their jobs (what they feel they give, receive, and want from their jobs), the structure of their jobs (rules and rewards associated with their positions), and the occupational stereotypes (what these are and where they are most prevalent). The methods used to gather the data were questionnaires, intensive interviews, behavioral observations, and research of records on personnel. Statistical results indicate that Staff and Technicians differ, as described in the stereotypes, because they receive different rewards. The employees tend to value the rewards that correlate with high job satisfaction as well as those which their positions provide. Those who receive the rewards which correlate with high job satisfaction concentrate more time, energy, and personal interest on their work roles than those who do not receive these rewards. The employees' focus on the rewards they receive and on their most satisfying roles is interpreted as a form of adaptation.

47966 **(LA—10503) Budget Division two-year plan, FY 1985-FY 1986.** Sahota, A. (comp.). (Los Alamos National Lab., NM (USA)). Aug 1985. Contract W-7405-ENG-36. 29p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85017950.

This two-year plan, developed by the Budget Division (BUD) management, outlines BUD's mission, organizational structure, functions, goals, and objectives. The plan is a part of BUD's capabilities and support services, which are available to any Laboratory organization. This report will be a working document for BUD and will be evaluated and updated annually.

47967 **(RISO-R—513) Energy Systems Group annual progress report 1984.** Grohnheit, P.E.; Larsen, H.; Villadsen, B. (eds.). (Risoe National Lab., Roskilde (Denmark)). Feb 1985. 48p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85702240.

The report describes the work of the Energy Systems Group at Risoe National Laboratory during 1984. The activities may be roughly classified as development and use of energy-economy models, energy systems analysis, energy technology assessment and energy planning. The report includes a list of staff members.

## 9902 Mathematics And Computers

*REFER ALSO TO CITATION(S) 46446, 46863, 46915, 46947, 47436, 47531, 47859*

47968 **(AD-A—154088/9/XAB) Nested dissection on a mesh-connected processor array.** Worley, P.H.; Schreiber, R. (Stanford Univ., CA (USA). Center for Large Scale Scientific Computation). Mar 1985. 33p. NTIS, PC A03/MF A01.

A parallel implementation is presented of Gaussian elimination without pivoting, using the nested dissection ordering for solving Ax=b where A is an N x N symmetric positive definite matrix. If the graph of A is a square root of N x square root of N finite element mesh then Birkhoff and George and Liu have shown that a parallel complexity of 0 (square root of N) can be achieved for Gaussian elimination with the nested dissection ordering. Implementation achieves this parallel complexity on a two-dimensional MIMD processor array with N processors and nearest neighbors interconnections. Thus nested dissection is a near-optimal algorithm for this problem on this interconnection topology. The parallel implementation on this architecture requires 158 square root of N + 0 (log of square root of N to base 2) parallel floating point multiplications. It is faster than a Kung-Leiserson systolic array for banded matrices for N greater than or equal to 961, and faster than a serial implementation for N as small as 9.

47969 **(CONF-8506181—1) FORTH implementation of the heap data structure for memory management.** Dress, W.B. (Oak Ridge National Lab., TN (USA)). 1985. Contract AC05-84OR21400. 23p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85017089.

From 4. Rochester conference; Rochester, NY, USA (12 Jun 1985).

The use of the heap for memory management provides the FORTH programmer with a versatile tool. Its use speeds program development at the conceptual level by allowing the program designer to consider dynamic arrays, garbage collection, and overlays; and at the implementation stage by providing a framework for easy manipulation of such data structures. An examination of the high-level codes leads naturally to examples of these and other techniques of dynamic data management.

47970 **(CONF-8508115—1) ANOVA model fitting via sparse matrix computations.** Ostrouchov, G. (Oak Ridge National Lab., TN (USA)). 1985. Contract AC05-84OR21400. 12p. NTIS, PC A02. File Number DE85017070.

From American Statistical Association for joint statistical meetings; Las Vegas, NV, USA (5 Aug 1985).

Full matrix methods for fitting large unbalanced ANOVA models require enormous amounts of time and storage. The model matrix X (often called the design matrix) consists of dummy variables and is sparse, thus great reduction in time and storage can be achieved by viewing this as a sparse matrix problem. A method, based on orthogonal Givens factorization of a maximal rank set of sparse columns of X, for fitting a model and computing the residual sum of squares is presented. The selection of a maximal rank set of sparse columns is based on a description of linear dependencies between columns of X that is developed using a notation based on index sets associated with model terms. A comparison of the new algorithm to a full matrix algorithm on a set of models shows that both time and storage requirements are reduced by up to three orders of magnitude for large models and are competitive for small models.

47971 **(CONF-8510116—1) Automated reasoning and various applications.** Wos, L. (Argonne National Lab., IL (USA)). 1985. Contract W-31-109-ENG-38. 17p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85014998.

From Autotestcon conference; Long Island, NY, USA (22 Oct 1985).

Automated reasoning has reached an important goal - the design and implementation of a computer program that functions as a valuable automated reasoning assistant. Automated reasoning assistants are currently used to verify properties of other computer programs, design and validate logic circuits, solve problems in control systems and robotics, and answer open questions in mathematics. Of the various reasoning programs, the most flexible is ITP, a program written in Pascal and offering the user many different options for attacking problems. The options include various types of reasoning, diverse strategies for restricting the reasoning and for directing it according to the user's knowledge and intuition, and auxiliary procedures that contribute to effectiveness. ITP can be used in interactive mode and in batch mode. It has been ported to various machines including the VAX, IBM 3033, PERQ, Apollo, Ridge, and Sun. The program is now being used by more than 100 institutions for research and for diverse applications.

47972 **(DTH-LV-R—84-32) BLAST - description of the subroutines in the BLAST program.** Christensen, J.E. (Danmarks Tekniske Hoejskole, Lyngby. Lab. for Varmeisolering). Oct 1984. 88p. NTIS (US Sales Only), PC A05/MF A01. File Number DE85752638.

This report describes the subroutines in the Building Loads Analysis and System Thermodynamics (BLAST) program, version 3:0 level 107, January 1984. The program is developed by the U.S. Army Construction Engineering Research Laboratory (CERL), Champaign, Illinois, USA. The purpose for the report is that people who are familiar with the use of the BLAST program easily can get an overview of the program.

47973 **(DTH-LV-R—84-33) BLAST - description of the subroutines in the report writer program.** Christensen, J.E. (Danmarks Tekniske Hoejskole, Lyngby. Lab. for Varmeisolering). Dec 1984. 32p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85752637.

This report describes the subroutines in the Report Writer program (RWRITER) - level 30 of the Building Loads Analysis and System Thermodynamics system. The program is developed by

the U.S. Army Construction Engineering Research Laboratory (CERL), Champaign, Illinois, USA. The purpose for the report is that the user who is familiar with the BLAST system easily can get an overview of the Report Writer program.

47974 **(FNAL-TM—1342) EPICS cookbook: a bare bones start.** Zamin, R. (Fermi National Accelerator Lab., Batavia, IL (USA)). Aug 1985. Contract AC02-76CH03000. 19p. NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85017672.

This booklet is a simple operator's guide to the EPICS system.

47975 **(JAERI-M—84-027) SAGEP: Two-dimensional sensitivity analysis code based on generalized perturbation theory.** Hara, Akihiro; Takeda, Toshikazu; Kikuchi, Yasuyuki. (Japan Atomic Energy Research Inst., Tokyo). Feb 1984. 35p. (In Japanese). NTIS (US Sales Only), PC A03/MF A01. File Number DE85702228.

A program SAGEP has been developed for calculation of sensitivity coefficients in a two-dimensional system. This code precisely predicts sensitivity coefficients for reactor performances to various cross-sections by means of generalized perturbation theory based on diffusion approximation. SAGEP calculates sensitivity coefficients for multiplication factor, reactivity worth, central reaction rate ratio, reaction rate distribution. The results are given for each reaction type and energy group. Neutron flux and adjoint flux previously calculated by the diffusion code CITATION-FBR are input to SAGEP, as well as microscopic and macroscopic cross sections obtained by SLAROM code. Included in this paper are the basic formulae of generalized perturbation theory, manual of input data, flow diagram, verification of obtained sensitivity coefficients. Lists of input data and its results for sample problems are given in Appendix.

47976 **(JAERI-M—84-039) Computer programs for heat transfer analysis in a horizontal annular porous insulation layer.** Shimomura, Hiroaki. (Japan Atomic Energy Research Inst., Tokyo). Mar 1984. 82p. NTIS (US Sales Only), PC A05/MF A01. File Number DE85702229.

Two computor programs have been developed to analyze natural convective heat transfer in an annular porous insulation layer which has a horizontal axis. In the insulation layer, it is considered that the Darcy's law rules the fluid motion and the effect of density variation on natural convection is taken into account basis of Boussinesq approximation. The boundary condition at the outer surface of insulation layer is applicable to both constant temperature and given heat transfer conditions for the energy equation. In solving the equations the successive over relaxation (SOR) method was employed for both momentum and energy equations and upwind difference-method was also applied to the convective term of energy equation to avoid the divergence of the solutions. The input data including some control parameters are briefly described with their formats and the output data are also explained. Elements of the programs including the main program and the fucntions of subroutines are described. The source program listing is appended.

47977 **(JAERI-M—84-061) MKENO-DAR: a direct angular representation Monte Carlo code for criticality safety analysis.** Naito, Yoshitaka; Komuro, Yuichi; Tsunoo, Yukiyasu; Nakayama, Mitsuo. (Japan Atomic Energy Research Inst., Tokyo). Mar 1984. 231p. NTIS (US Sales Only), PC A11/MF A01. File Number DE85702230.

Improving the Monte Carlo code MULTI-KENO, the MKENO-DAR (Direct Angular Representation) code has been developed for criticality safety analysis in detail. A function was added to MULTI-KENO for representing anisotropic scattering strictly. With this function, the scattering angle of neutron is determined not by the average scattering angle $\mu$-bar of the Pl Legendre polynomial but by the random work operation using probability distribution function produced with the higher order Legendre polynomials. This code is avilable for the FACOM-M380 computer. This report is a computer code manual for MKENO-DAR.

47978 **(JAERI-M—84-064) VISUAL: a software package for plotting data in the RADHEAT-V4 code system.** Sasaki, Toshihiko; Yamano, Naoki. (Japan Atomic Energy Research Inst., Tokyo). Mar 1984. 177p. NTIS (US Sales Only), PC A09/MF A01. File Number DE85702231.

In this report, the features, the capabilities and the constitution of the VISUAL Software Package are presented. The one of the features is that the VISUAL provides a versatile graphic display tool to plot a wide variety of data of the RADHEAT-V4 code system. And the other is to enable a user to handle easily the executing data in the Conversational Management Mode named "CMM". The program adopts the adjustable dimension system to increase its flexibility. VISUAL generates two-dimensional drawing, contour line map and three dimensional drawing on TSS (Time Sharing System) digital graphic equipment, NLP (Nihongo Laser Printer) or COM (Computer Output Microfilm). It is easily possible to display the calculated and experimental data in a DATA-POOL by using these functions. The purpose of this report is to describe sufficient information to enable a user to use VISUAL profitabily.

47979 **(JINR—10-84-420) Software for multiparameter experiments on DEMAS-MULTI setup using SM-3 type computers.** Kugler, A. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions). 1984. 12p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE85702234.

The software for multiparameter experiments at DEMAS-MULTI setup has been designed to sort simple events into the memory spectra and simultaneously to select coincidence events and to store them on a disk file. The data taking program can be restarted without any loss after the power supply breakdown. The experimental data can be sorted off-line by the same program. The sorting conditions can involve the condition of the specific correlation between two parameters. The description of the program operation and of the operator commands is presented.

47980 **(JINR—10-84-613) Retrieval and access of the information on decay and half-life in the ENSDF file.** Mircheva, D. (Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation). 1984. 5p. (In Russian). NTIS (US Sales Only), PC A02/MF A01. File Number DE85702235.

A method for the retrieval and access of the information on decay and half-life in the ENSDS computer evaluated nuclear structure data file is described. The obtained data can be used in the dosimetric research and radiation control. The ENSDF file is recorded on magnetic tapes which provides the sequential access. A method of negative strategies is used for the information netrieval. The obtained data are used for catalogue compiling. It includes the latest data obtained in various theoretical calculations and experimental studies.

47981 (JINR—D-13-84-53, pp 415-421) **Some problems of software for the network with radiochannel for data transmission.** Ofengenden, S.R.; Nazarova, E.I. (AN Ukrainskoj SSR, Kiev. Inst. Yadernykh Issledovanij). 1984. (In Russian). NTIS (US Sales Only), PC A20/MF A01. File Number DE85781324. (CONF-8309239—).

From 11. international symposium on nuclear electronics; Bratislava, Czechoslovakia (13 Sep 1983).

The construction problems system software for "Discret" and "Discret 2" networks on the radiochannel base as well as applied software for solving the nuclear physics problems are considered. "Discret 1" is a network in which equipment-based adapter and stack teleprocessing software are used. "Discret 2" is a network with adapter on the microcomputer base in which transport hardcopy log is realized. The characteristics of the radiochannel and hardcopy log for its controlling which are identical for both networks are given. The operated nowadays "Discret 1" network fragment consisting of the ES-1040 central computer and user centre on the M4030 computer base is described. A number of construction problems of the "Discret 2" network, particularly, hardcopy set applied log method radiochannel access organization, interaction with other networks is considered. The problems related to application of considered networks for the solution of nuclear physics problems

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are considered. The access to the stack for express-processing of experimental results obtained, for example in the course of studying three-particle nuclear reactions gamma spectroscopy in a bea is realized in quasireal time, while for the solution of theoretical nuclear physics problems - in a stack mode or by a beforehand drawn up chart.

47982 **(KAERC—1/84) Characteristic line method for solution of neutron transport equation.** Kim Jae Pyong. (State Committee for Atomic Energy, Pyongyang (D.P.R. of Korea). Research Center for Atomic Energy.). Aug 1984. 12p. (In Korean). NTIS (US Sales Only), PC A02/MF A01. File Number DE85702236.

In this paper characteristic line method for the solution of the neutron transport equation is investigated in case of infinite and finite cylindrical symmetric geometries. As regards the infinite cylindrical symmetry the algorithm of quadrature is modified and a direct method for the reflex boundary condition is newly suggested. Also the characteristic line method is extended to the finite cylindrical symmetry, and an algorithm of the direct method for the solution of the neutron transport equation is developed.

47983 **(KFK—3911) Function-manipulating-system SERVUS.** Thurnay, K. (Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Inst. fuer Neutronenphysik und Reaktortechnik; Kernforschungszentrum Karlsruhe G.m.b.H. (Germany, F.R.). Projekt Schneller Brueter). Apr 1985. 90p. (In German). NTIS (US Sales Only), PC A05/MF A01. File Number DE85752330.

SERVUS is a service-utility to store functions resulting from a numerical calculation in specially fitted data sets and display them later on. SERVUS enables also the user to manipulate the stored functions, before displaying them. The functions can be presented either as number-columns, or as a family of curves or as surfaces of functions. The paper describes the steps, needed for allocating a SERVUS-data set, for storing a function in this set, for reading a function from this data set, for cataloguing the functions, stored in the set, for copying a SERVUS-data set, for deleting stored functions, for printing stored functions and for drawing two or three-dimensional pictures of them.

47984 **(LA—10400-MS-Vol.1) Linked state machines: models. Vol. 1.** Knudsen, H.K. (Los Alamos National Lab., NM (USA)). Apr 1985. Contract W-7405-ENG-36. 20p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85017945.

The linked state machine (LSM) consists of a collection of elementary state machines (ESMs) that are linked together by signals that are derived from the states of the ESMs. LSMS are defined, and then shown to correspond to a special class of marked Petri nets. Linked state machines can be used to model the finite state, nondeterministic, and possibly concurrent processes that arise in the study of communications protocols, digital hardware, and computer programs. The models developed here form a foundation for the analysis and design of LSMs. Further properties of LSMs, and procedures for their analysis and design, are presented in the companion volumes of this report. 11 refs.

47985 **(LA—10400-MS-Vol.2) Linked state machines: composition. Volume 2.** Knudsen, H.K. (Los Alamos National Lab., NM (USA)). Apr 1985. Contract W-7405-ENG-36. 32p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85017946.

The composition of a linked state machine (LSM) is a procedure whereby the LSM can be re-represented or realized by an LSM that contains a smaller number of elementary state machines but has identical state behavior. The existence of a procedure for composition is one of the characterizing features of an LSM. A procedure for the composition of the special class of modified, marked Petri nets that are used to represent LSMs is given, and the properties of LSMs obtained through composition are derived. Next, staged or iterated composition is studied. Finally, procedures are derived for the composition of asynchronous LSMs.

47986 **(LA—10492-MS) Can mathematics explain natural intelligence.** Mycielski, J. (Los Alamos National Lab., NM (USA)). Jul 1985. Contract W-7405-ENG-36. 15p. NTIS, PC A02/MF A01; GPO Dep. File Number DE85017948.

The author discusses four algorithms that have one thing in common with the brain they learn to predict future events based on past experience. The first is the classical predictor x/sub t+h/ + 3x/sub t/ - 3x/sub t-h/ + x/sub t-2h/ for the values of a quadratic progression. The second predicts the values of linear functionals. The third predicts the vector outputs of an orthogonal operator. The fourth predicts the letters or morphemes of a text. The first, second, and fourth are simple enough so that mechanisms appropriate for the computations that they require could exist in our brains. The author proves estimates of the sum of the absolute squares of errors for the second and third algorithm.

47987 **(LA-UR—85-1391-Rev.) Speedup predictions for large scientific parallel programs on Cray X-MP-like architectures. Revision.** Williams, E.; Bobrowicz, F. (Los Alamos National Lab., NM (USA)). 1985. Contract W-7405-ENG-36. 4p. (CONF-850842—2-Rev.). NTIS, PC A02. File Number DE85015691.

From International conference on parallel processing; St. Charles, IL, USA (20 Aug 1985).

How much speedup can we expect for large scientific parallel programs running on supercomputers? For insight into this problem we extend the parallel processing environment currently existing on the Cray X-MP (a shared memory multiprocessor with at most four processors) to a simulated N-processor environment, where $N \leq 1$. Several large scientific parallel programs from Los Alamos National Laboratory were run in this simulated environment, and speedups were predicted. A speedup of 14.4 on 16 processors was measured for one of the three most used codes at the Laboratory.

47988 **(LBL—17801) Using cooperative simultaneous parallelism in nonhomogeneous microcomputer clusters.** Meng, J. (Lawrence Berkeley Lab., CA (USA)). Oct 1984. Contract AC03-76SF00098. 8p. (CONF-8410320—1). NTIS, PC A02/MF A01; 1; GPO Dep. File Number DE85017638.

From International Society for Mini and Microcomputers international symposium on applications of microcomputers; New York, NY, USA (22 Oct 1984).

Based on our experience controlling different types of microprocessors in clusters through the central processor-memory connection, and based on our successful parallel operation of a cluster of minicomputer central processors, a MIDAS-like arrangement of different microcomputers in a cluster is useful in dealing with a variety of problems. The MIDAS-like arrangement refers to master-slave control of the cluster by a minicomputer and to data being passed through the cluster by connecting prefilled memories into and out of processor address space. We discuss how to connect the hardware into a cluster and conclude with descriptions of how to apply the hardware to selected diverse applications. 11 refs., 8 figs.

47989 **(LUNFD6/NFFR—3048/1-27(1983)) DELTA - a computer program to analyze gamma-gamma angular correlations from unaligned states.** Ekstroem, L.P. (Lund Univ. (Sweden). Dept. of Physics). Oct 1983. 28p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85702237.

A computer program to analyze gamma-gamma angular correlations from radioactive decay and from thermal-neutron capture is described. The program can, in addition to correlation data, handle mixing ratio and conversion coefficient data.

47990 **(LUNFD6/NFFR—3049/1-27(1983)) FORTRAN 77 versions of string handling subprograms and the programs GTOL and MEDLIST.** Ekstroem, L.P.; Andersson, P. (Lund Univ. (Sweden). Dept. of Physics). Oct 1983. 28p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85702238.

The Nuclear Data Project (Oak Ridge National Laboratory) subprogram packages FORSTR and NSDLIB have been re-written in FORTRAN 77. The main modification is that character strings are stored as CHARACTER variables instead of INTEGER

arrays. The programs GTOL and MEDLIST have been modified to FORTRAN 77.

47991 **(PNL-SA—13277) Managing the data analysis process.** Nicholson, W.L.; Cowley, P.J.; Carr, D.B.; Whiting, M.A. (Pacific Northwest Labs., Richland, WA (USA)). May 1985. Contract AC06-76RL01830. 29p. (CONF-8411192—1). NTIS, PC A03/MF A01; 1; GPO Dep. File Number DE85016617.

From Data base management conference; Monterey, CA, USA (2 Nov 1984).

Data analysis is a sequential process which evolves as a network or analysis paths, some fruitful and some unproductive. Each node of the network represents a milestone of the analysis or a "data analysis save-state." Data analysis save-states and associated interactive software provide tools for effective management of the data analysis process. Save-states may be restored to review previous results, to verify what was done, or to continue the analysis. This paper describes the process of data analysis and its management and software tools developed for managing data analysis.

47992 **(UCID—19310-Rev.2) ORION: an interactive color post-processor for two dimensional finite element codes. Revision 2.** Hallquist, J.O.; Levatin, J.L. (Lawrence Livermore National Lab., CA (USA)). Aug 1985. 49p. NTIS, PC A03/MF A01. File Number DE85017876.

This report is a user's manual for the post-processor, ORION. ORION reads the binary plot files generated by the two-dimensional finite element codes currently used at LLNL. Contour and color fringe plots of a large number of quantities may be displayed on meshes consisting of triangular and quadrilateral elements. ORION can compute strain measures, interface pressures along slide lines, reaction forces along constrained boundaries, and momentum. ORION runs on the CRAY-1 and VAX computers. 8 refs., 16 figs.

47993 **(UCRL—92301) Indentation of a plane membrane with a rigid paraboloid.** Feng, W.W. (Lawrence Livermore National Lab., CA (USA)). 7 Mar 1985. Contract W-7405-ENG-48. 9p. (CONF-851096—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85012945.

From International conference on non-linear mechanics; Shanghai, China (28 Oct 1985).

The indentation of a rectangular nonlinear hyperelastic membrane by a rigid paraboloid is presented in this paper. The strain-energy-density function for the membrane is assumed to have the Mooney form. The total potential energy of the deformed membrane can be obtained by integration. Due to the presence of a rigid indentor, the total potential energy for a deformed membrane is subjected to an inequality constraint condition. A slack variable is introduced to convert the inequality constraint condition into an equality constraint condition. Furthermore, a substitutional method is used to eliminate one of the unknown variables. In order to solve for the remaining unknown variables, the Raleigh-Ritz method and the minimum potential energy principle are employed. The deformations of a square membrane under various degrees of indentation are presented.

47994 **(UCRL—93137) Review of tactical nuclear analysis and modeling limitations: 1955-1985.** Blumenthal, D.K. (Lawrence Livermore National Lab., CA (USA)). Aug 1985. Contract W-7405-ENG-48. 7p. (CONF-8509139—1). NTIS, PC A02/MF A01; GPO Dep. File Number DE85017274.

From International symposium on limitations of tactical nuclear modeling at the Royal Military College of Science; Shrivenham, Swindon, Wilt, UK (2 Sep 1985).

Only through computer models can we gain experience in tactical nuclear warfare. An unclassified review and criticism of combat modeling's operational and analytic assumptions is presented. Some generalized results of studies investigating synergistic relationshps of conventional and nuclear forces are discussed.

47995 **(USIP—84-01) Resolution enhancement by Fourier self-deconvolution.** Appelblad, O. (Stockholm Univ. (Sweden). Inst. of Physics). Mar 1984. 35p. NTIS (US Sales Only), PC A03/MF A01. File Number DE85702239.

The use of the Fourier self-deconvolution (FSD) method in a computer program operating with standard BOMEM interferogram files is described. Line broadening mechanisms are discussed as well as broadening effects on the measured positions of close-lying spectral lines.

47996 **Intelligent optical design program.** Bohachevsky, I.O.; Viswanathan, V.K.; Woodfin, G. (Los Alamos National Lab., NM). *Proceedings of the Society of Photo-Optical Instrumentation Engineers;* **485**: 104-112(1984).

From applications of artificial intelligence; Arlington, VA, USA (3-4 May 1984).

A general approach to the development of computer programs capable of designing image-forming optical systems without human intervention and of improving their performance with repeated attempts is described. The approach utilizes two ideas: (1) interpretation of technical design as a mapping in the configuration space of technical characteristics and (2) development of an intelligent routine that recognizes global optima. Examples of lens systems designed and used in the development of the general approach are presented, current status of the project is summarized, and plans for the future efforts are indicated.

## 9903 Information Handling

*REFER ALSO TO CITATION(S) 46608*

## 9904 Law

47997 **(INFO—0108) Regulation of nuclear activities in Canada.** Hamel, P.E. (Atomic Energy Control Board, Ottawa, Ontario (Canada)). 5 Dec 1983. 42p. (In English and French). NTIS (US Sales Only), PC A03/MF A01. File Number DE85702226.

This review was initiated by the OECD Nuclear Energy Agency for its series of analytical studies on nuclear legislation. It looks at the historic background and general overview of the use and handling of nuclear energy; the governmental framework controlling nuclear activities; and the agencies involved in its research and industrial applications. The regulatory power and structure of the Atomic Energy Control Board are highlighted.

## 9905 Civilian Defense

*REFER ALSO TO CITATION(S) 46715*

47998 **(UCRL—53540) International industrial protection initiatives. Final report.** Gregg, D.W. (Lawrence Livermore National Lab., CA (USA)). Dec 1984. Contract W-7405-ENG-48. 67p. NTIS, PC A04/MF A01; GPO Dep. File Number DE85017890.

We have performed a literature review of international industrial protection and overall civil defense initiatives, with an emphasis on NATO members and the neutral Western European nations of Austria, Finland, Sweden, and Switzerland. This review was supplemented and updated by interviews with civil defense personnel from the United Kingdom, France, Germany, and Sweden while they were attending the Defense Nuclear Agency (DNA) sponsored DIRECT COURSE Results Symposium from April 9 to 13, 1984. Of the eighteen nations reviewed only six have discretely separate industrial protection programs. However, all of them have civil defense programs, with Denmark, Norway, Sweden, and Switzerland having the most substantial programs. And, since civil defense and industrial protection tend to overlap, an overview of each nation's civil defense program is also presented. Of the nations where budget information could be obtained, only France spends less per capita than the United States on civil defense. We also briefly consider the significance of the well known intertwining of national economies and how it might relate to industrial protection. The potential role of treaties in contributing to industrial protection is discussed. 141 refs.

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47999 **(UCRL—53546) Time-dependent countermeasure considerations in industrial protection. Final report.** Spogen, L. (Lawrence Livermore National Lab., CA (USA)). May 1984. Contract W-7405-ENG-48. 37p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85017891.

Protecting industrial capability from nuclear attack may be done by employing various countermeasures intended to accomplish specific protective goals. Many potential countermeasures have previously been recommended without an appropriate consideration of their implementation times. A countermeasure's effectiveness in accomplishing a prescribed goal depends on the times when various actions associated with it are executed, and on the times required for their execution. We must therefore know about any time dependencies in the countermeasures. A countermeasure's effectiveness is also influenced by the level of protection needed by specific industries and the characteristics of those industries. An overview of basic interdependencies allows us to properly characterize the time dependencies existing in countermeasures. Considerations in this report include: dispersal, survivability requirements for critical industries, enhanced recovery measures, the characterization of industries, and the characterization of countermeasures. Based on these considerations, this report also describes a general method for providing a required post-attack industrial capability at a minimum cost. However, the development and collection of detailed information is needed before the method can be applied. 5 refs., 21 figs.

48000 **(UCRL—53583) Aerodynamic considerations in open shelters. Final report.** Hickman, R.G. (Lawrence Livermore National Lab., CA (USA)). Nov 1984. Contract W-7405-ENG-48. 41p. NTIS, PC A03/MF A01; GPO Dep. File Number DE85017944.

Aerodynamic factors are addressed bearing on the suitability of open structures as blast shelters. Blast closures and attenuator designs are discussed. The research on shelter filling is reviewed; this includes both experimental and theoretical work on scale models and full-scale structures of large dimensions. Shock-dominated and pressure-gradient-dominated shelter-filling mechanisms are described and their potential effects on people are discussed.

48001 **(UCRL—53647) Toward quantifying the source term for predicting global climatic effects of nuclear war: applications of urban fire codes.** Reitter, T.A.; Kang, S.W.; Takata, A.N. (Lawrence Livermore National Lab., CA (USA)). 15 Jun 1985. Contract W-7405-ENG-48. 94p. NTIS, PC A05/MF A01; 1; GPO Dep. File Number DE85017456.

Calculating urban-area fire development is critical to estimating global smoke production effects due to nuclear warfare. To improve calculations of fire starts and spread in urban areas, we performed a parameter-sensitivity analysis using three codes from IIT Research Institute. We applied improved versions of the codes to two urban areas: an infinite "uniform city" with only one type of building and the "San Jose urban area" as of the late 1960s. We varied parameters and compared affected fuel consumption and areas with a baseline case. The dominant parameters for the uniform city were wind speed, atmospheric visibility, frequency of secondary fire starts, building density, and window sizes. For San Jose (1968), they were wind speed, building densities, location of ground zero (GZ), height of burst (HOB), window sizes, and brand range. Because some results are very sensitive to actual fuel-distribution characteristics and the attack scenario, it is not possible to use a uniform city to represent actual urban areas. This was confirmed by a few calculations for the Detroit area as of the late 1960s. Many improvements are needed, such as inclusion of fire-induced winds and debris fires, before results can be extrapolated to the global scale.

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In the Corporate Author Index, report literature is indexed using the name of the organization or institution responsible for issuing the report. Headings are provided for all report literature and for published literature for which a corporate approach is especially desirable, e.g., symposium and conference proceedings.

Each entry under a corporate heading gives the document title and the volume and abstract numbers. The document type, e.g., R for Report; country of publication, e.g., US; and language of the document, e.g., In German, are given in parentheses at the end of the entry. If no language statement appears, the language is English. Tables of document types and country of publication codes appear after the indexes.

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Title, (supplementary information), citation number, (R;US)

The notations in the final parentheses indicate the type of document, e.g., R for Report; the country of publication, e.g., US; and the language if other than English, e.g., In German. Tables of document types and country of publication codes appear after the indexes.

The title may be supplemented with additional words, or a phrase, if it appears additional information would be helpful. In cases for which the title contains little or no information related to the subject entry, it may be replaced entirely by the supplementary information. A qualifier is not always required, and in such cases the title will follow the unqualified subject descriptor.

The descriptors selected for use as subject terms are generally the names of specific materials, things, or processes. To the extent possible, a qualifier is selected to describe the properties of, or processes applied to, the subject term.

Index entries are selected to indicate the important ideas and concepts presented in a document, rather than words that may appear in the text. Within the available thesaurus terms, the most probable or logical place to look for typical information is selected. "See references" are included to guide users from synonymous terms or phrases to the descriptor selected as a subject heading for the concept (e.g., Pipeline Quality Gas, see HIGH BTU GAS). "See also references" are used to indicate where to find references to subject concepts that are narrower, broader, or related to a particular subject heading. To complete an exhaustive search of a given subject, all such headings should be reviewed. Copies of DOE/TIC-7000, the Subject Thesaurus, are available from the National Technical Information Service (NTIS), U.S. Department of Commerce, Springfield, VA 22161.

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| **AC08-82NV10250** | **Westinghouse Electric Corp., Mercury, NV (USA). Waste Technology Services Div.** | |
| | 10:46175 | DOE/NV/10250—21 |
| **AC08-83NV10270** | **Science Applications International Corp., Las Vegas, NV (USA)** | |
| | 10:46190 | NVO—196-45 |
| **AC08-83NV10282** | **EG and G Energy Measurements, Inc., Las Vegas, NV (USA)** | |
| | 10:46917 | EGG—10282-1087 |
| | **EG and G, Inc., Goleta, CA (USA)** | |
| | 10:47138 | EGG—10282-2062 |
| **AC09-76SR00001** | **Du Pont de Nemours (E.I.) and Co., Aiken, SC (USA). Savannah River Lab.** | |
| | 10:46176 | DP-MS—85-13 |
| | 10:46177 | DP-MS—85-16A |
| | 10:46178 | DP-MS—85-16B |
| | 10:46210 | DP-MS—85-81 |
| | **Environmental and Chemical Sciences, Inc., Aiken, SC (USA)** | |
| | 10:47297 | DPST—85-376 |
| | 10:47300 | DPST—85-377 |
| **AC11-76PN00014** | **Bettis Atomic Power Lab., West Mifflin, PA (USA)** | |
| | 10:46574 | WAPD-TM—1393 |
| | 10:46915 | WAPD-T—2869 |
| | 10:46948 | WAPD-T—2865 |
| | 10:46949 | WAPD-T—2867 |

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| AC18-81FC10271 | Texas A and M Univ., College Station (USA). Dept. of Civil Engineering | |
| | 10:46396 | DOE/FC/10271—1875 |
| AC21-79ET15440 | United Technologies Corp., South Windsor, CT (USA) | |
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| AC21-79MC10761 | Extranuclear Labs., Inc., Pittsburgh, PA (USA) | |
| | 10:47137 | DOE/MC/10761—1880 |
| AC21-80ET17091 | General Electric Co., Schenectady, NY (USA). Advanced Energy Programs Dept. | |
| | 10:46395 | DOE/ET/17091—1864 |
| AC21-80MC14101 | Jenike and Johanson, Inc., North Billerica, MA (USA) | |
| | 10:45969 | DOE/MC/14101—1847 |
| AC21-81FE05123 | Avco-Everett Research Lab., Inc., Everett, MA (USA) | |
| | 10:45940 | DOE/FE/05123—1879 |
| AC21-81MC16471 | Denver Research Inst., CO (USA) | |
| | 10:46397 | DOE/MC/16471—1887 |
| AC21-81MC16537 | Georgia Inst. of Tech., Atlanta (USA). School of Chemistry | |
| | 10:46046 | DOE/MC/16537—1764 |
| AC21-82MC19208 | Washington State Univ., Pullman (USA). Dept. of Chemical Engineering | |
| | 10:45942 | DOE/MC/19208—1891 |
| AC21-82MC19392 | Environmental Research and Technology, Inc., Pittsburgh, PA (USA) | |
| | 10:45977 | DOE/MC/19392—1826 |
| AC21-83MC20094 | Energy Research Corp., Danbury, CT (USA) | |
| | 10:46637 | DOE/MC/20094—1729 |
| AC21-83MC20110 | Acurex Corp., Mountain View, CA (USA). Energy and Environmental Div. | |
| | 10:45978 | DOE/MC/20110—1895 |
| AC21-84MC20107 | Pennsylvania State Univ., University Park (USA) | |
| | 10:46398 | DOE/MC/20107—T3 |
| AC22-76ET10532 | Chevron Research Co., Richmond, CA (USA) | |
| | 10:45934 | DOE/ET/10532—T26 |
| AC22-76ET10592 | Suntech, Inc., Marcus Hook, PA (USA). Research and Engineering Div. | |
| | 10:45935 | DOE/ET/10592—T1 |
| | 10:45936 | DOE/ET/10592—T2 |
| | Suntech, Inc., Marcus Hook, PA (USA) | |
| | 10:45937 | DOE/ET/10592—T4 |
| | Suntech, Inc., Marcus Hook, PA (USA). Applied Research and Development Dept. | |
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| | 10:45966 | DOE/ET/10592—T5 |
| AC22-78ET13378 | Purdue Univ., Lafayette, IN (USA). Dept. of Chemistry | |
| | 10:45967 | DOE/ET/13378—T1 |
| AC22-79ET14700 | Utah Univ., Salt Lake City (USA). Dept. of Fuels Engineering | |
| | 10:45938 | DOE/ET/14700—T1-Vol.4 |
| | 10:45939 | DOE/ET/14700—T1-Vol.5 |
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| AC22-80PC30027 | Conoco, Inc., Library, PA (USA). Coal Research Div. | |
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| AC22-81PC40077 | Union Carbide Corp., Tarrytown, NY (USA). Molecular Sieve Dept. | |
| | 10:46248 | DOE/PC/40077—T9 |
| AC22-83PC60047 | Cities Service Research and Development Co., Tulsa, OK (USA) | |
| | 10:45945 | DOE/PC/60047—T8 |
| AC22-83PC60408 | Viking Energy Corp., Pittsburgh, PA (USA) | |
| | 10:46619 | DOE/PC/60408—T3 |
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| AC22-84PC70018 | Conoco, Inc., Library, PA (USA). Coal Research Div. | |
| | 10:45947 | DOE/PC/70018—9 |
| AC22-84PC70028 | Union Carbide Corp., Tarrytown, NY (USA). Molecular Sieve Dept. | |
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| AC22-84PC70509 | Stanford Univ., CA (USA). High Temperature Gasdynamics Lab. | |
| | 10:46632 | DOE/PC/70509—T3 |
| AC79-84BP11797 | Water Budget Center, Portland, OR (USA) | |
| | 10:47298 | DOE/BP/11797—2 |
| AI01-76ET20320 | Electrotek Concepts, Inc., Knoxville, TN (USA) | |
| | 10:46387 | DOE/NASA—4105-1 |
| AI01-76ET20356 | Jet Propulsion Lab., Pasadena, CA (USA) | |
| | 10:46312 | DOE/JPL—1012-104 |
| AI04-80AL12726 | National Aeronautics and Space Administration, Cleveland, OH (USA). Lewis Research Center | |
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| AI06-78DP01078 | Washington State Univ., Pullman | |
| | 10:47456 | Journal of Petrology 25 NO. 2. 473-500 (May 1984). |
| AI19-82BC10749 | National Bureau of Standards, Washington, DC (USA) | |
| | 10:46063 | DOE/BC/10749—3 |
| AI21-83MC20417 | Jet Propulsion Lab., Pasadena, CA (USA) | |
| | 10:45943 | DOE/MC/20417—1745 |
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| AI21-83MC20422 | Geological Survey, Denver, CO (USA) | |
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| AI79-82BP35097 | Oregon Dept. of Fish and Wildlife, Portland (USA). Columbia River Section | |
| | 10:47299 | DOE/BP/35097—2 |
| AI79-82BP35346 | Fish and Wildlife Service, Cook, WA (USA). Willard Field Station | |
| | 10:46269 | DOE/BP/35346—1 |
| AI79-83BP13084 | Fish and Wildlife Service, Seattle, WA (USA). Seattle National Fishery Research Center | |
| | 10:47331 | DOE/BP/13084—1 |
| AI79-84BP16479 | Oregon State Univ., Corvallis (USA). Dept. of Microbiology | |
| | 10:47328 | DOE/BP/16479—1 |
| AM04-80AL13137 | Jet Propulsion Lab., Pasadena, CA (USA) | |
| | 10:46272 | DOE/JPL—1060-88 |
| AS03-82ER60031 | California Univ., San Diego, La Jolla (USA). Inst. of Marine Resources | |
| | 10:47262 | DOE/ER/60031—T1 |
| AS05-76ER03509 | Florida State Univ., Tallahassee (USA). Dept. of Physics | |
| | 10:47553 | DOE/ER/03509—21 |
| | 10:47569 | Physical Review Letters 55 NO. 8. 779-782 (19 Aug 1985). |
| AS05-76ER04447 | Los Alamos National Lab., NM (USA) | |
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| AS05-76ER05173 | Maryland Univ., College Park (USA). Dept. of Chemistry | |
| | 10:46831 | DOE/ER/05173—T1 |
| AS05-76EV03728 | Washington Univ., Seattle (USA). Social Management of Technology Program | |
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| AS05-78EV05855 | Florida State Univ., Tallahassee | |
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| | Florida State Univ., Tallahassee (USA) | |
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| AS05-79ER10459 | Louisiana State Univ., Baton Rouge (USA). Dept. of Physics and Astronomy | |
| | 10:47882 | DOE/ER/45135—12 |
| AS05-80ER10713 | Virginia Polytechnic Inst. and State Univ., Blacksburg (USA) | |
| | 10:47063 | DOE/ER/10713—6B |
| AS05-83ER13127 | Tennessee Univ., Knoxville (USA). Dept. of Chemistry | |
| | 10:46832 | DOE/ER/13127—05 |

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| AS05-83ER45027 | Department of Materials Science and Engineering, University of Florida, Gainesville, Florida 32611 | |
| | 10:47170 | Journal of Vacuum Science and Technology, A: Vacuum, Surfaces, and Films 3 NO. 5. 1973-198 |
| AS09-76EV00089 | Skidaway Institute of Oceanography, Savannah, GA | |
| | 10:47272 | Journal of Geophysical Research 88 NO. C8. 4730-4738 (30 May 1984). |
| AS20-81LC10783 | Wyoming Univ., Laramie (USA). Dept. of Physics and Astronomy | |
| | 10:46094 | DOE/LC/10783—1866-Vol.3 |
| | Wyoming Univ., Laramie (USA) | |
| | 10:46095 | DOE/LC/10783—1866-Vol.6 |
| AS20-82LC10845 | Denver Research Inst., CO (USA) | |
| | 10:46833 | DOE/LC/10845—1828 |
| AS21-80MC14322 | New York Univ., NY (USA). Dept. of Applied Science | |
| | 10:46045 | DOE/MC/14322—1800 |
| AT01-79CS20528 | National Bureau of Standards, Washington, DC (USA). Metallurgy Div. | |
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| AT01-81CS40521 | National Bureau of Standards, Washington, DC (USA). Center for Chemical Engineering | |
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| AT03-81ER10867 | Stanford Univ., CA | |
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| | 10:46951 | Experiments in Fluids 2 57-64 (1984). |
| AT03-81EV10651 | California Univ., Los Angeles (USA) | |
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| AT03-84ER52104 | University of California, Los Angeles School of Engineering and Applied Science, Los Angeles, Califo | |
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| AT06-81EV10611 | Oregon State Univ., Corvallis (USA). Coll. of Oceanography | |
| | 10:47270 | DOE/EV/10611—5 |
| AT06-83ER13121 | Washington Univ., Seattle (USA) | |
| | 10:47881 | DOE/ER/13121—T1 |
| FC02-80CS30261 | Johnson Controls, Inc., Milwaukee, WI (USA) | |
| | 10:46353 | DOE/CS/30261—T1 |
| FC05-77ET10069 | Exxon Research and Engineering Co., Annandale, NJ (USA) | |
| | 10:45933 | DOE/ET/10069—T116 |
| FC07-82ID12424 | Bailey Controls Co., Wickliffe, OH (USA) | |
| | 10:46906 | DOE/ID/12424—T1 |
| FC07-84ID12495 | Physical Sciences, Inc., Andover, MA (USA) | |
| | 10:46635 | CONF-850836—5 |
| FC21-83FE60181 | North Dakota Univ., Grand Forks (USA). Energy Research Center | |
| | 10:45941 | DOE/FE/60181—165 |
| | 10:45968 | DOE/FE/60181—116 |
| FG01-78ET12227 | Duke Univ., Durham, NC (USA). Dept. of Mechanical Engineering and Materials Science | |
| | 10:46636 | DOE/ET/12227—T1 |
| FG01-78ET20026 | Utah State Univ., Logan (USA). Inst. of Land Rehabilitation | |
| | 10:46310 | DOE/ET/20026—T1 |
| | 10:46311 | DOE/ET/20026—T2 |
| FG01-80IR10342 | Northern California Indian Development Council, Inc., Eureka | |
| | 10:46270 | DOE/IR/10342—T1 |
| FG01-84EI19683 | New York Energy Office, Albany (USA) | |
| | 10:46616 | DOE/EI/19683—T1 |
| FG01-84EI19686 | Massachusetts Executive Office of Energy Resources, Boston (USA) | |
| | 10:46617 | DOE/EI/19686—T1 |
| FG01-84EI19692 | New Jersey Dept. of Energy, Newark (USA) | |
| | 10:46618 | DOE/EI/19692—T1 |
| FG01-85CE15195 | Cleary (James M.), Falmouth, MA (USA) | |
| | 10:46583 | DOE/CE/15195—T1 |
| | Cleary (James M.), Falmouth, MA (USA) | |
| | 10:46584 | DOE/CE/15195—T2 |
| FG02-84ER40176 | The Rockefeller University, New York, New York 10021 | |
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| FG02-85ER13323 | Pennsylvania State Univ., University Park (USA) | |
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| FG02-85ER60297 | Colorado State Univ., Fort Collins (USA). Dept. of Fishery and Wildlife Biology | |
| | 10:47259 | DOE/ER/60297—1 |
| FG02-85ER75172 | American Nuclear Society, La Grange Park, IL | |
| | 10:46443 | DOE/ER/75172—3 |
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| FG03-78SF01974 | Sencenbaugh Wind Electric, Mountain View, CA (USA) | |
| | 10:46388 | DOE/SF/01974—T1 |
| FG05-79IR10295 | American Association of Community and Junior Colleges, Washington, DC. Energy Communications Center | |
| | 10:46605 | DOE/IR/10295—T3 |
| | National Council for Resource Development, Washington, DC (USA) | |
| | 10:46606 | DOE/IR/10295—T4 |
| | American Association of Community and Junior Colleges, Washington, DC. Energy Communications Center | |
| | 10:46607 | DOE/IR/10295—T5 |
| FG05-80ER10157 | Alabama A and M Coll., Normal (USA) | |
| | 10:46092 | DOE/ER/10157—1 |
| FG05-83OR21389 | CONEG Policy Research Center, Inc., Washington, DC (USA) | |
| | 10:46315 | DOE/OR/21389—5 |
| | 10:46631 | DOE/OR/21389—6 |
| FG05-84ER45114 | Tennessee Univ., Knoxville (USA). Dept. of Chemistry | |
| | 10:46792 | DOE/ER/45114—1 |
| FG22-80PC30229 | Massachusetts Inst. of Tech., Cambridge (USA) | |
| | 10:46878 | DOE/PC/30229—6 |
| FG22-82PC50801 | Southern Illinois Univ., Carbondale (USA) | |
| | 10:45971 | DOE/PC/50801—11 |
| FG22-83PC60779 | Signal Research Center, Inc., Des Plaines, IL (USA) | |
| | 10:46861 | DOE/PC/60779—7 |
| FG22-83PC60800 | Brown Univ., Providence, RI (USA). Div. of Engineering | |
| | 10:45946 | DOE/PC/60800—7 |
| FG22-84PC70003 | Pennsylvania State Univ., University Park (USA). Coll. of Earth and Mineral Sciences | |
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| FG22-84PC70786 | State Univ. of New York, Binghamton (USA). Dept. of Chemistry | |
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| FG22-84PC70788 | Notre Dame Univ., IN (USA). Dept. of Chemical Engineering | |
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| FG22-84PC70790 | Polytechnic Inst. of New York, Brooklyn (USA) | |
| | 10:45951 | DOE/PC/70790—T3 |
| FG22-84PC70796 | Utah Univ., Salt Lake City (USA). Dept. of Fuels Engineering | |
| | 10:46038 | DOE/PC/70796—4 |
| FG22-84PC71257 | Pittsburgh Univ., PA (USA) | |
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| FG22-84PC79892 | Tuskegee Inst., AL (USA). Dept. of Chemical Engineering | |
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| FG43-79R306073 | Bertrand (Frank J.), Towanda, PA (USA) | |
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| FG43-81R308090 | Mid-Atlantic Solar Energy Association, Philadelphia, PA (USA) | |
| | 10:46354 | DOE/R3/08090—T6 |
| NAS-7-100-956786 | Westinghouse Research and Development Center, Pittsburgh, PA (USA) | |
| | 10:46314 | DOE/JPL/956786—85/5 |
| NAS-7-918-956766 | Wilkes Coll., Wilkes-Barre, PA (USA) | |
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| RA22-84PC70754 | Minnesota Univ., St. Paul (USA). Dept. of Chemistry | |
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| | Colorado State Univ., Fort Collins (USA) | |
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| | Los Alamos National Lab., NM (USA) | |
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| | 10:47530 | DOE/ER/03077—266 |
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| | Structural Mechanics Associates, Inc., Newport Beach, CA (USA) | |
| | 10:46419 | UCRL—84185 |
| | Lawrence Livermore National Lab., CA (USA) | |
| | 10:46420 | UCRL—84190 |
| | 10:46464 | UCRL—84183 |
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| | 10:46567 | UCRL—15340 |
| | **Massachusetts Inst. of Tech., Cambridge (USA)** | |
| | 10:46568 | UCRL—84184 |
| | **Lawrence Livermore National Lab., CA (USA)** | |
| | 10:46569 | UCRL—85702 |
| | **EDS Nuclear, Inc., Walnut Creek, CA (USA)** | |
| | 10:46570 | UCRL—85703 |
| | **Lawrence Livermore National Lab., CA (USA)** | |
| | 10:46571 | UCRL—85706 |
| | 10:46572 | UCRL—86209 |
| | 10:46573 | UCRL—92070 |
| | 10:46590 | UCRL—92832 |
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| | 10:46715 | UCRL—53627 |
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| 1 | *See* SSI-A-84-16 | DE85702148 | MN -41 | 10:47871 |
| CONF-8310228- | (6. Soviet national conference on neutron physics, Kiev, USSR, 10-14 Oct 1983) | | | |
| Vol.1 | *See* INIS-SU-301 | DE85781590 | MN -20 | 10:47858 |
| CONF-840139- | (SPIE technical symposium and instrument exhibit, Los Angeles, CA, USA, 22-27 Jan 1984) | | | |
| | Proc. Soc. Photo-Opt. Instrum. Eng., 464: 64-72(1984) | | | 10:47956 |
| CONF-8403194- | (15. spring symposium on high energy physics, Georgenthal, German D.R., 26-30 Mar 1984) | | | |
| | *See* KMU-HEP-84-08 | DE85781587 | MN -34D | 10:47536 |
| CONF-8403199- | (International symposium on cosmic ray and particle physics, Tokyo, Japan, 19-23 Mar 1984) | | | |
| 1 | *See* PITHA-84/32 | DE85752318 | MN -34D | 10:47564 |
| 2 | *See* PITHA-84/21 | DE85752319 | MN -34D | 10:47563 |

| *Report Number* | *Availability Source* | *File Number* | | *Distribution Category* | *Abstract Number* |
|---|---|---|---|---|---|
| **CONF-840435-** | (International school of nuclear physics - nuclear and subnuclear degrees of freedom and lepton nucleus scattering course, Erice, Trapani, Italy, 8-20 Apr 1984) | | | | |
| | Prog. Part. Nucl. Phys., 13: 299-327(1985) | | | | 10:47650 |
| **CONF-8404252-** | (GRECO seminar, Palaiseau, France, 26 Apr 1984) | | | | |
| 1 | *See* CEA-CONF-7277 | | DE85752181 | MN -34 | 10:47854 |
| **CONF-840512-** | (6. congress of the International Radiation Protection Association, Berlin, F.R. Germany, 7-12 May 1984) | | | | |
| 20 | *See* F-84025 | | DE85702070 | MN -20 | 10:47939 |
| 23 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: | DE85016144 | MN -41 | 10:47864 |
| **CONF-8405155-** | (Inner space/outer space conference, Batavia, IL, USA, 2-5 May 1984) | | | | |
| 8 | *See* FNAL/C-85-100-A | E 1.99: | DE85013220 | MN -34B | 10:47472 |
| **CONF-8405193-** | (Conference on the intersections between particle and nuclear physics, Steamboat Springs, CO, USA, 23-30 May 1984) | | | | |
| 48 | *See* DOE/ER/40105-480 | E 1.99: | DE85012589 | MN -34D | 10:47583 |
| **CONF-8405317-** | (Workshop on product quality sensors, Hamilton, Ontario, Canada, 8-10 May 1984) | | | | |
| 1 | *See* AECL-8354 | | DE85701987 | MN -25 | 10:46952 |
| **CONF-8405340-** | (Symposium on applications of radiation thermometry, Gaithersburg, MD, USA, 8 May 1984) | | | | |
| I-Draft | NTIS, PC A02/MF A01; 1 (GPO Dep.) | E 1.99: | DE85016401 | MN -37 | 10:47136 |
| **CONF-8405344-** | (Conference on modern electrochemical engineering, Stockholm, Sweden, 15 May 1984) | | | | |
| | *See* IVA-274 | | DE85752519 | MN -94cc | 10:46882 |
| **CONF-8406133-** | (DARPA propagation meeting, Monterey, CA, USA, 18-22 Jun 1984) | | | | |
| 18 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: | DE85016133 | MN -28 | 10:47024 |
| **CONF-8406175-** | (International Association of Science and Technology for Development international conference on applied simulation and modeling, San Francisco, CA, USA, 4-6 Jun 1984) | | | | |
| 2 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: | DE85016378 | MN -11 | 10:47197 |
| **CONF-8406183-** | (15. international symposium on multiparticle dynamics, Lund, Sweden, 11-16 Jun 1984) | | | | |
| 12 | *See* CERN-EP-84-96 | | DE85901942 | MN -34D | 10:47576 |
| **CONF-8406194-** | (NATO advanced study institute on nonequilibrium quantum statistical mechanics, Santa Fe, NM, USA, 3-16 Jun 1984) | | | | |
| 4 | *See* DOE/ER/45135-12 | E 1.99: | DE85016841 | MN -34 | 10:47882 |
| **CONF-8406221-** | (7. international seminar on high energy physics problems, multiquark interactions and quantum chromodynamics, Dubna, USSR, 19-23 Jun 1984) | | | | |
| 4 | *See* CERN-EP-84-112 | | DE85902034 | MN -34D | 10:47544 |
| **CONF-8406234-** | (International symposium on phase transitions in the very early universe, Bielefeld, F.R. Germany, 4-8 Jun 1984) | | | | |
| | Nucl. Phys. B, 252: No. 1/2, 113-125(25 Mar 1985) | | | | 10:47487 |
| | Nucl. Phys. B, 252: No. 1/2, 53-72(25 Mar 1985) | | | | 10:47488 |
| | Nucl. Phys. B, 252: No. 1/2, 81-111(25 Mar 1985) | | | | 10:47489 |
| | Nucl. Phys. B, 252: No. 1/2, 321-330(25 Mar 1985) | | | | 10:47490 |
| **CONF-8406260-** | (27. colloquium on metallurgy, Saclay, France, 18-20 Jun 1984) | | | | |
| 1 | *See* CEA-CONF-7731 | | DE85752178 | MN -70 | 10:46171 |
| **CONF-8406271-** | (10. Nordic conference on mathematical statistics, Bolkesjo, Norway, 19-21 Jun 1984) | | | | |
| 1 | *See* LITH-IKP-R-367 | | DE85752522 | MN -38 | 10:47436 |
| **CONF-8406272-** | (Symposium on domestic fuels in small combustion plants, Stockholm, Sweden, 6 Jun 1984) | | | | |
| | *See* IVA-275 | | DE85752543 | MN -61D | 10:46661 |
| **CONF-840757-** | (22. international conference on high energy physics, Leipzig, German D.R., 19-25 Jul 1984) | | | | |
| 36 | *See* CERN-EP-84-101 | | DE85901941 | MN -34D | 10:47543 |
| **CONF-840788-** | (International conference on the physics of highly ionized atoms, Oxford, UK, 2-5 Jul 1984) | | | | |
| 3 | *See* CEA-CONF-7409 | | DE85752171 | MN -25 | 10:46780 |
| **CONF-840789-** | (International conference on particles and nuclei, Heidelberg, F.R. Germany, 30 Jul-3 Aug 1984) | | | | |
| 11 | *See* CEA-CONF-7414 | | DE85752151 | MN -34D | 10:47575 |
| 12 | *See* CEA-CONF-7579 | | DE85752159 | MN -34D | 10:47541 |
| 13 | *See* CEA-CONF-7577 | | DE85752160 | MN -34D | 10:47540 |
| 14 | *See* CEA-CONF-7572 | | DE85752161 | MN -34D | 10:47669 |
| 15 | *See* CEA-CONF-7571 | | DE85752162 | MN -34D | 10:47697 |
| 16 | *See* CERN-EP-84-112 | | DE85902034 | MN -34D | 10:47544 |
| **CONF-8407112-** | (12. SLAC summer institute on particle physics, Stanford, CA, USA, 23 Jul-3 Aug 1984) | | | | |
| | *See* SLAC-281 | E 1.99: | DE85015805 | STD -34D | 10:47565 |
| **CONF-8407116-** | (Seminar on Cerenkov detectors and their applications in science and technology, Moscow, USSR, 1 Jul 1984) | | | | |
| 2 | *See* CERN-EP-84-98 | | DE85902033 | MN -34D | 10:47058 |

| Report Number | Availability Source | File Number | | Distribution Category | Abstract Number |
|---|---|---|---|---|---|
| CONF-8407121- | (5. international symposium on surfactants in solution, Bordeaux, France, 9-13 Jul 1984) | | | | |
| 3 | *See* CEA-CONF-7724 | | DE85752170 | MN -48 | 10:47352 |
| CONF-8407128- | (International meeting on therapeutical chemistry, Chatenay-Malabry, France, 10-12 Jul 1984) | | | | |
| 1 | *See* CEA-CONF-7716 | | DE85752167 | MN -48 | 10:47351 |
| CONF-8407142- | (NATO advanced study institute on molecular astrophysics: state of the art and future directions, Garching, F.R. Germany, 1 Jul 1984) | | | | |
| 1 | *See* UCRL-92919 | E 1.99: | DE85017261 | MN -34B | 10:47479 |
| CONF-840805- | (188. meeting of the American Chemical Society, Philadelphia, PA, USA, 26-31 Aug 1984) | | | | |
| 31-Rev.2 | *See* UCRL-90774-Rev.2 | E 1.99: | DE85014180 | MN -4 | 10:47460 |
| CONF-840807- | (Conference on chemical thermodynamics and 39. calorimetry conference, Hamilton, Canada, 13-17 Aug 1984) | | | | |
| | J. Nucl. Mater., 130: 473-488(Feb 1985) | | | | 10:46903 |
| CONF-840820- | (27. international geological congress, Moscow, USSR, 4-14 Aug 1984) | | | | |
| Vol.9-Pt.1-Summs. | *See* INIS-SU-299 | | DE85781599 | MN -4 | 10:47445 |
| CONF-8408139- | (INS-RIKEN international symposium on heavy ion physics, Tokyo, Japan, 24-25 Aug 1984) | | | | |
| 2 | *See* CEA-CONF-7415 | | DE85752156 | MN -34C | 10:47688 |
| CONF-8408160- | (NATO advanced study institute on techniques and concepts of high energy physics, St. Croix, VI, USA, 2-13 Aug 1984) | | | | |
| 1 | *See* CERN-EP-85-54 | | DE85901950 | MN -34D | 10:47059 |
| CONF-8408168- | (22. international school of subnuclear physics on quarks, leptons and their constituents, Erice, Trapani, Sicily, 5-15 Aug 1984) | | | | |
| 1 | NTIS, PC A03/MF A01 (GPO Dep.) | E 1.99: | DE85016057 | MN -34D | 10:47550 |
| CONF-8408169- | (Symposium on the role of chemicals and radiation in the etiology of cancer, Chicago, IL, USA, 26-29 Aug 1984) | | | | |
| 1 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: | DE85016293 | MN -48 | 10:47403 |
| CONF-840908- | (2. BHRA international symposium on the large scale applications of heat pumps, York, UK, 25-27 Sep 1984) | | | | |
| | *See* PB-85-189538/XAB | | | | 10:46700 |
| CONF-840922- | (5. APS topical conference on high temperature plasma diagnostics, Tahoe City, CA, USA, 16-20 Sep 1984) | | | | |
| 23 | *See* CEA-CONF-7419 | | DE85752154 | MN -37 | 10:46241 |
| CONF-840945- | (Topical conference on neutron-nucleus collisions--a probe of nuclear structure, Glouster, OH, USA, 5-8 Sep 1984) | | | | |
| 12 | NTIS, PC A02; 3 | | DE85017083 | MN -34C | 10:47689 |
| CONF-8409103- | (5. Riso international symposium on metallurgy and materials science, Roskilde, Denmark, 3-7 Sep 1984) | | | | |
| 5 | *See* CEA-CONF-7433 | | DE85752153 | MN -25 | 10:46718 |
| CONF-8409115- | (6. annual Low-Level Waste Management Program participants' information meeting, Denver, CO, USA, 11-13 Sep 1984) | | | | |
| 19 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: | DE85017096 | MN -70B | 10:46208 |
| CONF-8409143- | (7. international conference on atomic masses and fundamental constants (AMCO-7), Darmstadt-Seeheim, F.R. Germany, 3-7 Sep 1984) | | | | |
| | *See* INIS-mf-9351 | | DE85781594 | MN -34C | 10:47655 |
| CONF-8409144- | (Free electron laser conference, Castelgandolfo, Italy, 3-7 Sep 1984) | | | | |
| 6 | *See* CEA-CONF-7590 | | DE85752157 | MN -34 | 10:47048 |
| 7 | *See* CEA-CONF-7587 | | DE85752163 | MN -28 | 10:47047 |
| 8 | *See* CEA-CONF-7727 | | DE85752179 | MN -22 | 10:46159 |
| CONF-8409171- | (Workshop on electron cooling, Karlsruhe, F.R. Germany, 22-26 Sep 1984) | | | | |
| 4 | *See* CERN-EP-85-56 | | DE85901952 | MN -28 | 10:47008 |
| CONF-8409240- | (French Society of Chemistry congress, Nancy, France, 17-21 Sep 1984) | | | | |
| 2 | *See* CEA-CONF-7614 | | DE85752172 | MN -25 | 10:46790 |
| 3 | *See* CEA-CONF-7615 | | DE85752173 | MN -25 | 10:46791 |
| CONF-8409263- | (Symposium of QSAR in toxicology and xenobiochemistry, Praha, Czechoslovakia, 12-14 Sep 1984) | | | | |
| 1 | NTIS, PC A02/MF A01; 1 (GPO Dep.) | E 1.99: | DE85017094 | MN -41 | 10:47404 |
| CONF-8409266- | (BTECC moisture workshop, Washington, DC, USA, 25-26 Sep 1984) | | | | |
| 1 | NTIS, PC A02/MF A01; 1 (GPO Dep.) | E 1.99: | DE85017098 | MN -95d | 10:46647 |
| CONF-8410204- | (3. European conference on nondestructive testing, Florence, Italy, 15-18 Oct 1984) | | | | |
| 2 | *See* CEA-CONF-7679 | | DE85752166 | MN -38 | 10:46953 |
| CONF-8410210- | (7. high energy heavy ion study conference, Darmstadt, F.R. Germany, 8-13 Oct 1984) | | | | |
| | *See* GSI-85-10 | | DE85752251 | MN -34C | 10:47792 |

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|---|---|---|---|---|---|
| CONF-8410282- | (7. Nordic Society for Radiation Protection ordinary meeting, Copenhagen, Denmark, 10-12 Oct 1984) | | | | |
| Abstr. | *See* INIS-mf-9758 | | DE85781601 | MN -51 | 10:47390 |
| CONF-8410286- | (17. OTAN specialists meeting on chemoprophylaxis, Brussels, Belgium, 23-25 Oct 1984) | | | | |
| 1 | *See* CEA-CONF-7692 | | DE85752168 | MN -48 | 10:47350 |
| 2 | *See* CEA-CONF-7680 | | DE85752169 | MN -48 | 10:47349 |
| CONF-8410310- | (Animal toxicology related to energy industries, Knoxville, TN, USA, 22-26 Oct 1984) | | | | |
| 1 | NTIS, PC A03/MF A01 (GPO Dep.) | E 1.99: | DE85016390 | MN -13 | 10:46246 |
| CONF-8410317- | (24. project integration meeting, Pasadena, CA, USA, 2-3 Oct 1984) | | | | |
| Summ. | *See* DOE/JPL-1012-104 | E 1.99: | DE85017592 | STD -63b | 10:46312 |
| CONF-8410320- | (International Society for Mini and Microcomputers international symposium on applications of microcomputers, New York, NY, USA, 22-24 Oct 1984) | | | | |
| 1 | *See* LBL-17801 | E 1.99: | DE85017638 | MN -32 | 10:47988 |
| CONF-841121- | (AIChE annual meeting, San Francisco, CA, USA, 25-29 Nov 1984) | | | | |
| 23 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: | DE85016382 | MN -4 | 10:46881 |
| CONF-841155- | (1. joint symposium on dry SO/sub 2/ and simultaneous SO/sub 2//NO/sub x/ control technologies, San Diego, CA, USA, 13-16 Nov 1984) | | | | |
| Vol.1 | *See* EPRI-CS-4178-Vol.1 | | TI85920790 | ND -90i | 10:46022 |
| CONF-841184- | (30. annual conference on magnetism and magnetic materials, San Diego, CA, USA, 27-30 Nov 1984) | | | | |
| 33-Rev. | *See* SLAC-PUB-3512-Rev. | E 1.99: | DE85015754 | MN -25 | 10:46760 |
| CONF-8411173- | (Seminar on application of ionizing radiation in foods and feeds treatment, Prague, Czechoslovakia, 28 Nov 1984) | | | | |
| | *See* INIS-mf-9743 | | DE85781606 | MN -23 | 10:47372 |
| CONF-8411181- | (Colloquium on heat transfer hydrotechnique in underground applications to thermal exploitation, Paris, France, 14-15 Nov 1984) | | | | |
| 1 | *See* CEA-CONF-7483 | | DE85751913 | MN -94a | 10:46581 |
| CONF-8411192- | (Data base management conference, Monterey, CA, USA, 2 Nov 1984) | | | | |
| 1 | *See* PNL-SA-13277 | E 1.99: | DE85016617 | MN -32 | 10:47991 |
| CONF-841238- | (12. Texas symposium of relativistic astrophysics, Jerusalem, Israel, 17-21 Dec 1984) | | | | |
| 1 | *See* UCRL-92510 | E 1.99: | DE85017398 | MN -34B | 10:47477 |
| CONF-841275- | (DOE and DOE contractors' radioactive and hazardous material packaging workshop, Germantown, MD, USA, 4-6 Dec 1984) | | | | |
| 1 | *See* RHO-ML-SA-3 | E 1.99: | DE85015393 | MN -11 | 10:47241 |
| CONF-841276- | (The Hawaii Nobel Laureate symposium, Honolulu, HI, USA, 16-22 Dec 1984) | | | | |
| 1 | *See* LBL-19875 | E 1.99: | DE85016632 | MN -34A | 10:47517 |
| CONF-850128- | (2. international workshop on laser acceleration of particles, Los Angeles, CA, USA, 7-18 Jan 1985) | | | | |
| | American Inst. of Physics, 335 East 45th Street, New York, NY 10017 | | TI85017258 | ND -28 | 10:46989 |
| CONF-850152- | (3. LEAR workshop, Tignes-Savoie, France, 19-26 Jan 1985) | | | | |
| 9 | *See* CERN-EP-85-48 | | DE85901960 | MN -34D | 10:47545 |
| 10 | *See* CERN-EP-85-53 | | DE85901956 | MN -34D | 10:47547 |
| 11 | *See* CERN-EP-85-69 | | DE85901951 | MN -34D | 10:47670 |
| 12 | *See* CERN-EP-85-65 | | DE85901949 | MN -34D | 10:47548 |
| 13 | *See* CERN-EP-85-47 | | DE85901948 | MN -34D | 10:47773 |
| CONF-850175- | (EPRI end-use metering workshop, Seattle, WA, USA, 15-16 Jan 1985) | | | | |
| 6 | *See* PNL-SA-13190 | E 1.99: | DE85017899 | MN -95d | 10:46456 |
| CONF-850211- | (114. AIME annual meeting (includes Society of Mining Engineers), New York, NY, USA, 24-28 Feb 1985) | | | | |
| 13 | NTIS, PC A02/MF A01; 1 (GPO Dep.) | E 1.99: | DE85016481 | MN -25 | 10:46719 |
| CONF-850231- | (15. plasma physics conference, Lucas Heights, Australia, 4-6 Feb 1985) | | | | |
| Abstr. | *See* INIS-mf-9902 | | DE86780004 | MN -34A | 10:47901 |
| CONF-850266- | (2. international school for space simulation, Honolulu, HI, USA, 3-15 Feb 1985) | | | | |
| 8 | *See* UCRL-92259 | E 1.99: | DE85016088 | MN -34A | 10:47916 |
| CONF-850278- | (5. topical workshop on proton-anti-proton collider physics, St. Vincent, Italy, 25 Feb-1 Mar 1985) | | | | |
| 7 | *See* CERN-EP-85-82 | | DE85901961 | MN -34D | 10:47549 |
| 9 | *See* CERN-EP-85-51 | | DE85901957 | MN -34D | 10:47546 |
| CONF-850296- | (2. biennial symposium on issues and technology in the management of impacted western wildlife, Glenwood, CO, USA, 4-6 Feb 1985) | | | | |
| 1 | *See* PNL-SA-12895 | E 1.99: | DE85016615 | MN -11 | 10:47261 |
| CONF-850315- | (Conference on antinucleon and nucleon-nucleus interactions, Telluride, CO, USA, 18-21 Mar 1985) | | | | |
| 10 | *See* CERN-EP-85-79 | | DE85902044 | MN -34D | 10:47664 |

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|---|---|---|---|---|
| CONF-850345- | (Southwest conference on optics, Albuquerque, NM, USA, 4-8 Mar 1985) | | | |
| 32 | *See* LA-UR-85-2879 | E 1.99: DE85017557 | MN -34 | 10:46934 |
| CONF-8503105- | (Orbital dynamics and applications to accelerators workshop, Berkeley, CA, USA, 7-12 Mar 1985) | | | |
| 8 | *See* LBL-19797 | E 1.99: DE85016565 | MN -28 | 10:47021 |
| 9 | *See* UCRL-92531 | E 1.99: DE85013223 | MN -28 | 10:47023 |
| CONF-8503121- | (American Society of Nondestructive Testing spring conference, Washington, DC, USA, 11-14 Mar 1985) | | | |
| 1-Rev.1 | *See* UCRL-92271-Rev.1 | E 1.99: DE85013792 | MN -23 | 10:47322 |
| CONF-850414- | (General meeting of the American Physical Society, Washington, DC, USA, 25-27 Apr 1985) | | | |
| 1 | *See* LA-UR-85-2346 | E 1.99: DE85015678 | MN -34D | 10:47561 |
| CONF-850417- | (189. national meeting of the American Chemical Society, Miami, FL, USA, 28 Apr-3 May 1985) | | | |
| 27 | *See* RFP-3802 | E 1.99: DE85013229 | MN -10 | 10:46851 |
| 28 | *See* IS-M-560 | E 1.99: DE85017344 | MN -90a | 10:45973 |
| CONF-850470- | (4. international conference on electrostatic accelerator technology and associated boosters, Buenos Aires, Argentina, 15-19 Apr 1985) | | | |
| 9 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: DE85016392 | MN -28 | 10:46990 |
| 10 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: DE85016393 | MN -28 | 10:46991 |
| CONF-8504103- | (American Nuclear Society student conference, Gainesville, FL, USA, 4-7 Apr 1985) | | | |
| Absts. | *See* DOE/ER/75172-2 | DE85016926 | MN -2 | 10:47856 |
| CONF-8504134- | (26. Instrument Society of America modeling and simulation conference, Pittsburgh, PA, USA, 25-26 Apr 1985) | | | |
| 2 | NTIS, PC A02/MF A01; 1 (GPO Dep.) | E 1.99: DE85013225 | MN -13 | 10:47957 |
| CONF-8504152- | (Workshop on experiments for RHIC, Upton, NY, USA, 15-19 Apr 1985) | | | |
| 5 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: DE85016471 | MN -28 | 10:46992 |
| 6 | *See* BNL-36780 | E 1.99: DE85016063 | MN -34D | 10:47057 |
| CONF-8504153- | (NATO advanced studies conference on scaling phenomena in disordered systems, Geilo, Norway, 10-21 Apr 1985) | | | |
| 2 | *See* BNL-36704 | E 1.99: DE85017509 | MN -34A | 10:46798 |
| CONF-8504162- | (Workshop on radio biological effectiveness of neutrons, Germantown, MD, USA, 9 Apr 1985) | | | |
| | NTIS, PC A03/MF A01; 1 (GPO Dep.) | E 1.99: DE85017577 | STD -48 | 10:47367 |
| CONF-8504168- | (ANSYS conference, Pittsburgh, PA, USA, 24 Apr 1985) | | | |
| 1 | *See* IS-M-542 | E 1.99: DE85015511 | MN -80 | 10:46524 |
| CONF-8504169- | (Workshop on nuclear and particle physics at intermediate energies with hadrons (ICTP), Trieste, Italy, 1-3 Apr 1985) | | | |
| 1 | *See* LA-UR-85-2352 | E 1.99: DE85015676 | MN -28 | 10:47003 |
| CONF-8504172- | (Western Region American Nuclear Society student conference, Tucson, AZ, USA, 12-14 Apr 1985) | | | |
| Absts. | *See* DOE/ER/75172-3 | E 1.99: DE85016927 | MN -2 | 10:46443 |
| CONF-8504174- | (Energy sources: conservation and renewables, Washington, DC, USA, 27-28 Apr 1985) | | | |
| 1 | NTIS, PC A03/MF A01; 1 (GPO Dep.) | E 1.99: DE85016364 | MN -95d | 10:46648 |
| CONF-850504- | (Particle accelerator conference, Vancouver, Canada, 13-16 May 1985) | | | |
| 256 | *See* LBL-19528 | E 1.99: DE85016562 | MN -28 | 10:47020 |
| 263 | *See* FNAL-TM-1325 | E 1.99: DE85017444 | STD -28 | 10:47026 |
| 264 | *See* FNAL-TM-1329 | E 1.99: DE85017445 | STD -28 | 10:46995 |
| 265 | *See* FNAL-TM-1324 | E 1.99: DE85017438 | STD -28 | 10:47010 |
| 266 | *See* FNAL-TM-1327 | E 1.99: DE85017440 | STD -28 | 10:47027 |
| 267 | *See* FNAL-TM-1314 | E 1.99: DE85017439 | STD -28 | 10:47025 |
| 268 | *See* FNAL-TM-1330 | E 1.99: DE85017443 | STD -28 | 10:46996 |
| 269 | *See* FNAL-TM-1328 | E 1.99: DE85017442 | MN -28 | 10:47012 |
| 270 | *See* FNAL-TM-1326 | E 1.99: DE85017441 | STD -28 | 10:47011 |
| 271 | *See* DOE/ER/40124-6 | E 1.99: DE85017419 | MN -28 | 10:46994 |
| 272 | *See* DOE/ER/40124-5 | E 1.99: DE85017418 | MN -28 | 10:46993 |
| 273 | *See* LBL-19903 | E 1.99: DE85017649 | MN -28 | 10:47005 |
| 274 | *See* LBL-18946 | E 1.99: DE85017640 | MN -28 | 10:47041 |
| 275 | *See* LBL-18963 | E 1.99: DE85017642 | MN -28 | 10:47516 |
| 276 | *See* LBL-18953 | E 1.99: DE85017641 | MN -48 | 10:47515 |
| 277 | *See* LBL-18966 | E 1.99: DE85017643 | MN -28 | 10:47004 |
| 278 | *See* LBL-19601 | E 1.99: DE85017645 | MN -28 | 10:47949 |
| 279 | *See* LBL-18962 | E 1.99: DE85017669 | MN -28 | 10:47042 |
| CONF-850507- | (International conference on nuclear data for basic and applied science, Santa Fe, NM, USA, 13-17 May 1985) | | | |
| 52 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: DE85016157 | MN -34C | 10:47698 |
| CONF-850542- | (167. Electrochemical Society meeting, Toronto, Ontario, Canada, 12-17 May 1985) | | | |
| 5 | *See* LA-UR-85-2212 | E 1.99: DE85014086 | MN -94cc | 10:46793 |
| 6 | *See* LBL-19490 | E 1.99: DE85014545 | MN -94cc | 10:46593 |
| CONF-850574- | (Chemometrics research conference, Gaithersburg, MD, USA, 20-22 May 1985) | | | |
| 1 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: DE85017085 | MN -13 | 10:46827 |

| Report Number | Availability Source | File Number | Distribution Category | Abstract Number |
|---|---|---|---|---|
| CONF-8505139- | (9. annual actinide separations workshop, Richland, WA, USA, 22-24 May 1985) | | | |
| 6 | *See* RFP-3824 | E 1.99: DE85013215 | MN -4 | 10:46166 |
| CONF-8505164- | (Workshop on high brightness, high current, high duty factor ion injectors, San Diego, CA, USA, 21-23 May 1985) | | | |
| 7 | *See* LBL-19809 | E 1.99: DE85016557 | MN -28 | 10:47022 |
| CONF-8505166- | (Symposium on nuclear structure, Copenhagen, Denmark, 20-24 May 1985) | | | |
| 3 | *See* BNL-36789 | E 1.99: DE85017522 | MN -34D | 10:47539 |
| CONF-8505172- | (Conference on nuclear structure with heavy ions, Legnaro, Padova, Italy, 27-31 May 1985) | | | |
| 3 | *See* LBL-19806 | E 1.99: DE85016630 | MN -34C | 10:47759 |
| CONF-8505174- | (IDA workshop on gamma-ray lasers, Alexandria, VA, USA, 21-22 May 1985) | | | |
| 2 | *See* LA-UR-85-2701 | E 1.99: DE85015737 | MN -34C | 10:47843 |
| CONF-8505175- | (TPSS meeting, Atlanta, GA, USA, 15-16 May 1985) | | | |
| 5 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: DE85017308 | MN -20 | 10:47932 |
| CONF-8505178- | (Collaborative study on short-term tests for genotoxicity and carcinogenicity, Cap d'Adge, France, 14-21 May 1985) | | | |
| 2 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: DE85016961 | MN -48 | 10:47405 |
| CONF-8505185- | (1. international symposium on VLSI technology, systems, and applications, Taipei, Taiwan, China, 8-10 May 1985) | | | |
| 1 | *See* SAND-85-0546C | E 1.99: DE85008210 | MN -37 | 10:47133 |
| CONF-8505188- | (Conference on quark confinement and liberation: numerical results and theory, Berkeley, CA, USA, 22-24 May 1985) | | | |
| 1 | *See* LBL-19746 | E 1.99: DE85016645 | MN -34D | 10:47639 |
| CONF-8505189- | (Atomic theory workshop on relativistic and QED effects in heavy atoms, Gaithersburg, MD, USA, 23-24 May 1985) | | | |
| 1 | *See* LBL-19884 | E 1.99: DE85016633 | MN -34 | 10:47518 |
| CONF-8505190- | (3. Capri symposium on symmetry and supersymmetry in nuclear and subnuclear physics, Capri, Italy, 20-24 May 1985) | | | |
| 1 | *See* LA-UR-85-2704 | E 1.99: DE85015735 | MN -34C | 10:47844 |
| CONF-8505192- | (Symposium on the recent developments in quantum field theory, Copenhagen, Denmark, 6-10 May 1985) | | | |
| 1 | *See* SLAC-PUB-3703 | E 1.99: DE85014957 | MN -34D | 10:47617 |
| CONF-8505194- | (Conference on characterization of contaminant emissions from indoor sources, Triangle Park, NC, USA, 13-15 May 1985) | | | |
| 1 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: DE85013222 | MN -41 | 10:47206 |
| CONF-8505195- | (EPA conference on characterization of sources of indoor air contaminants, Chapel Hill, SC, USA, 12-14 May 1985) | | | |
| 1 | NTIS, PC A02/MF A01; 1 (GPO Dep.) | E 1.99: DE85013233 | MN -41 | 10:47207 |
| CONF-8505196- | (Limeil Laboratory of the French Atomic Energy Commission meeting, Paris, France, 6-10 May 1985) | | | |
| 1 | *See* UCRL-92565 | E 1.99: DE85016075 | MN -34 | 10:47875 |
| CONF-850604- | (INTERSOL '85 - Solar energy--the diverse solution, Montreal, Canada, 23-29 Jun 1985) | | | |
| 16 | *See* LBL-19271 | E 1.99: DE85016551 | MN -59B | 10:46371 |
| 17 | *See* SERI/TP-253-2744 | E 1.99: DE85012163 | MN -59B | 10:46377 |
| CONF-850605- | (7. international conference on laser spectroscopy, Maui, HI, USA, 24-28 Jun 1985) | | | |
| 4 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: DE85016380 | MN -34B | 10:47471 |
| CONF-850606- | (American Society of Heating, Refrigerating and Air-Conditioning Engineers' semiannual meeting, Honolulu, HI, USA, 23-27 Jun 1985) | | | |
| 15 | NTIS, PC A02/MF A01; 1 (GPO Dep.) | E 1.99: DE85016376 | MN -59B | 10:46643 |
| CONF-850610- | (Annual meeting of the American Nuclear Society, Boston, MA, USA, 9-14 Jun 1985) | | | |
| 36 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: DE85016414 | MN -79p | 10:46501 |
| 47 | NTIS, PC A03/MF A01 (GPO Dep.) | E 1.99: DE85016366 | MN -83 | 10:46163 |
| CONF-850612- | (Air Pollution Control Association annual meeting and exhibition, Detroit, MI, USA, 16-21 Jun 1985) | | | |
| 9 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: DE85016410 | MN -41 | 10:47205 |
| CONF-850670- | (ASME Pressure Vessel and Piping Division conference, New Orleans, LA, USA, 24-29 Jun 1985) | | | |
| 22 | NTIS, PC A02/MF A01 - GPO | TI85016420 | MN -78 | 10:46720 |
| CONF-8506100- | (3. IEEE conference on human factors and power plants, Monterey, CA, USA, 23-27 Jun 1985) | | | |
| 4 | NTIS, PC A02/MF A01 - GPO | TI85017153 | MN -78 | 10:46441 |
| 5 | NTIS, PC A02/MF A01 - GPO | TI85017152 | MN -80 | 10:46442 |
| CONF-8506109- | (NATO workshop on chemical reactions in inorganic and organic constrained systems, Orleans, France, 23-28 Jun 1985) | | | |
| 2 | *See* LA-UR-85-2994 | E 1.99: DE85017539 | MN -34A | 10:47514 |
| CONF-8506110- | (Review of progress in quantitative NDE, Williamsburg, VA, USA, 23-28 Jun 1985) | | | |
| 2 | *See* LA-UR-85-2840 | E 1.99: DE85017564 | MN -38 | 10:46964 |

| Report Number | Availability Source | File Number | | Distribution Category | Abstract Number |
|---|---|---|---|---|---|
| CONF-8506117- | (41. meeting of the IMOG subgroup on environmental testing, Miamisburg, OH, USA, 18 Jun 1985) | | | | |
| 3 | *See* SAND-85-1807C | E 1.99: | DE85017116 | MN -37 | 10:47162 |
| CONF-8506125- | (Conference on internal friction and ultrasonic attenuation in solids, Urbana, IL, USA, 3-6 Jun 1985) | | | | |
| 7 | *See* IS-M-561 | E 1.99: | DE85017346 | MN -25 | 10:46714 |
| 8 | *See* BNL-36833 | E 1.99: | DE85017510 | MN -25 | 10:46717 |
| CONF-8506137- | (4. international conference on environmental mutagens, Stockholm, Sweden, 24-28 Jun 1985) | | | | |
| 11 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: | DE85016353 | MN -48 | 10:47406 |
| 12 | *See* UCRL-92130 | E 1.99: | DE85017399 | MN -48 | 10:47429 |
| CONF-8506143- | (9. North American workshop on cataclysmic variables, Seattle, WA, USA, 24-26 Jun 1985) | | | | |
| 4-Rev.1 | *See* UCRL-92823-Rev.1 | E 1.99: | DE85017280 | MN -34B | 10:47478 |
| CONF-8506149- | (Manned mars mission workshop, Huntsville, AL, USA, 10-14 Jun 1985) | | | | |
| 3 | *See* LA-UR-85-2443 | E 1.99: | DE85015716 | MN -33 | 10:47537 |
| CONF-8506155- | (Health and environmental effects of complex chemical mixtures, Chicago, IL, USA, 17-18 Jun 1985) | | | | |
| | NTIS, PC A06/MF A01 (GPO Dep.) | E 1.99: | DE85016336 | STD -41 | 10:47407 |
| CONF-8506157- | (Conference on computing in high energy physics, Amsterdam, Netherlands, 25-28 Jun 1985) | | | | |
| 3 | *See* FNAL/C-85/94 | E 1.99: | DE85015817 | MN -34D | 10:47535 |
| 4 | *See* SLAC-PUB-3705 | E 1.99: | DE85016503 | MN -34D | 10:47538 |
| CONF-8506169- | (17. AMS-SIAM summer seminar in applied mathematics, Ithaca, NY, USA, 30 Jun-13 Jul 1985) | | | | |
| 2 | *See* LA-UR-85-2332 | E 1.99: | DE85015681 | MN -4 | 10:46907 |
| CONF-8506176- | (International Precious Metals Institute conference and exhibit, New York, NY, USA, 10-13 Jun 1985) | | | | |
| 1 | *See* PNL-SA-12972 | E 1.99: | DE85016277 | MN -86 | 10:46160 |
| CONF-8506178- | (Cretan international meeting on subatomic physics, Crete, Greece, 23-29 Jun 1985) | | | | |
| 2 | *See* LA-UR-85-2281 | E 1.99: | DE85014069 | MN -34D | 10:47842 |
| CONF-8506179- | (Engineered organisms in the environment: a cross-disciplinary symposium, Philadelphia, PA, USA, 10-13 Jun 1985) | | | | |
| 1 | NTIS, PC A03/MF A01 (GPO Dep.) | E 1.99: | DE85016377 | MN -11 | 10:47239 |
| CONF-8506181- | (4. Rochester conference, Rochester, NY, USA, 12-15 Jun 1985) | | | | |
| 1 | NTIS, PC A02/MF A01; 1 (GPO Dep.) | E 1.99: | DE85017089 | MN -32 | 10:47969 |
| CONF-8506185- | (22. annual meeting of the poplar council of the United States, Lawrence, KS, USA, 25-27 Jun 1985) | | | | |
| 1 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: | DE85016590 | MN -61A | 10:46307 |
| CONF-8506187- | (12. international symposium on cerebral blood flow and metabolism, Lund, Sweden, 16-20 Jun 1985) | | | | |
| 1 | *See* BNL-36886 | | DE85017516 | MN -48 | 10:47309 |
| CONF-850701- | (14. international conference on the physics of electronic and atomic collisions, Palo Alto, CA, USA, 24-30 Jul 1985) | | | | |
| 2 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: | DE85017412 | MN -34A | 10:47501 |
| CONF-850706- | (8. international symposium on detonation, Albuquerque, NM, USA, 15-19 Jul 1985) | | | | |
| 30 | *See* LA-UR-85-2510 | E 1.99: | DE85015701 | MN -37 | 10:47159 |
| CONF-850711- | (22. annual conference on nuclear and space radiation effects, Monterey, CA, USA, 22-24 Jul 1985) | | | | |
| 13 | *See* SAND-85-0691C | E 1.99: | DE85017117 | MN -37 | 10:47134 |
| CONF-850713- | (International conference on nuclear power plant aging, availability factor and reliability analysis, San Diego, CA, USA, 7-12 Jul 1985) | | | | |
| | *See* BNL-NUREG-36799 | | TI85017519 | MN -78 | 10:46500 |
| CONF-850715- | (7. international congress and exhibition on laser opto-electronics, Munich, F.R. Germany, 1-5 Jul 1985) | | | | |
| 1 | *See* LBL-18909 | E 1.99: | DE85016631 | MN -37 | 10:47124 |
| CONF-850720- | (International nuclear reactor decommissioning planning conference, Bethesda, MD, USA, 16-18 Jul 1985) | | | | |
| 4 | *See* PNL-SA-13161 | | TI85016912 | MN -78 | 10:46558 |
| CONF-850736- | (American Physical Society topical conference on shock waves in condensed matter, Spokane, WA, USA, 22-26 Jul 1985) | | | | |
| 60 | *See* SAND-85-1647C | | DE85016802 | MN -25 | 10:46783 |
| CONF-850742- | (International Pyrotechnics Society symposium, Karlsruhe, F.R. Germany, 3-5 Jul 1985) | | | | |
| 2 | *See* MLM-3291(OP) | E 1.99: | DE85017421 | MN -45 | 10:47184 |
| CONF-850755- | (Symposium on physics and chemistry of glass and glassmaking, Alfred, NY, USA, 30 Jul-2 Aug 1985) | | | | |
| 3 | *See* DP-MS-85-16A | E 1.99: | DE85016453 | MN -70 | 10:46177 |
| 4 | *See* DP-MS-85-16B | E 1.99: | DE85017059 | MN -70 | 10:46178 |
| 5 | *See* PNL-SA-13305 | E 1.99: | DE85017919 | MN -70 | 10:46196 |
| CONF-850758- | (5. international conference on mathematical modelling, Berkeley, CA, USA, 29-31 Jul 1985) | | | | |
| 2 | NTIS, PC A03/MF A01 (GPO Dep.) | E 1.99: | DE85016357 | MN -38 | 10:46943 |

| Report Number | Availability Source | File Number | Distribution Category | Abstract Number |
|---|---|---|---|---|
| CONF-850759- | (10. high pressure conference on research in high pressure science and technology, Amsterdam, Netherlands, 8-11 Jul 1985) | | | |
| 13 | *See* LA-UR-85-3064 | E 1.99: DE85017530 | MN -28 | 10:47873 |
| CONF-850765- | (26. annual meeting of the Institute of Nuclear Materials Management, Albuquerque, NM, USA, 21-24 Jul 1985) | | | |
| 25 | *See* MLM-3278(OP) | E 1.99: DE85016448 | MN -15 | 10:46230 |
| 27 | *See* MLM-3285(OP) | E 1.99: DE85016446 | MN -15 | 10:47160 |
| 29 | *See* RFP-3792 | E 1.99: DE85013212 | MN -15 | 10:46231 |
| 31 | *See* SAND-85-1131C | E 1.99: DE85016581 | MN -15 | 10:46233 |
| 32 | *See* SAND-85-1677C | E 1.99: DE85017232 | MN -16 | 10:46234 |
| 33 | *See* RHO-SS-SA-18P | E 1.99: DE85017242 | MN -15 | 10:46852 |
| 34 | *See* BNL-36854 | E 1.99: DE85017515 | MN -15 | 10:46224 |
| 35 | *See* LA-UR-85-3043 | E 1.99: TI85017532 | MN -16 | 10:46229 |
| 36 | *See* BNL-36806 | E 1.99: DE85017548 | MN -41 | 10:47204 |
| CONF-850770- | (EXPLOMET '85 - international conference on metallurgical applications of shock wave and high strain-rate phenomena, Portland, OR, USA, 28 Jul-1 Aug 1985) | | | |
| 6 | *See* SAND-85-0485C | E 1.99: DE85016815 | MN -25 | 10:46755 |
| 7 | *See* SAND-85-0322C | E 1.99: DE85017381 | MN -25 | 10:46754 |
| 8 | *See* LA-UR-85-3026 | E 1.99: DE85017533 | MN -25 | 10:46744 |
| 9 | *See* LA-UR-85-2821 | E 1.99: DE85017567 | MN -25 | 10:46740 |
| CONF-850776- | (Joint symposium on swarm studies and inelastic electron-molecule collisions, Tahoe, CA, USA, 19-23 Jul 1985) | | | |
| 1 | NTIS, PC A03/MF A01 (GPO Dep.) | E 1.99: DE85016473 | MN -34A | 10:47502 |
| CONF-850777- | (3. international aluminum-lithium conference, Oxfordshire, England, 9-11 Jul 1985) | | | |
| 2 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: DE85016356 | MN -25 | 10:46721 |
| 3 | *See* LBL-19236 | E 1.99: DE85017644 | MN -25 | 10:46745 |
| CONF-850779- | (Cavity decoupling workshop, Pajaro Dunes, CA, USA, 29-31 Jul 1985) | | | |
| 1 | *See* UCRL-93194 | E 1.99: DE85017271 | MN -38 | 10:47195 |
| CONF-850780- | (NATO advanced study institute on fundamentals of transport phenomena in porous media, Newark, DE, USA, 14-23 Jul 1985) | | | |
| 1 | *See* PNL-SA-13282 | E 1.99: DE85016621 | MN -11 | 10:47282 |
| CONF-850782- | (National weatherization conference, Portland, OR, USA, 15-19 Jul 1985) | | | |
| 1 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: DE85016354 | MN -95d | 10:46644 |
| CONF-850783- | (PV and isolation measurements workshop, Vail, CO, USA, 1-3 Jul 1985) | | | |
| 1 | *See* SAND-85-1421C | E 1.99: DE85016193 | MN -63b | 10:46346 |
| 2 | *See* SAND-85-1764C | E 1.99: DE85016542 | MN -63 | 10:46347 |
| CONF-850785- | (5. international conference on physics in collision, Autun, France, 3-5 Jul 1985) | | | |
| 1 | *See* SLAC-PUB-3730 | E 1.99: DE85016905 | MN -34D | 10:47566 |
| CONF-850786- | (International conference on the physics and chemistry of boron and boron-rich borides, Albuquerque, NM, USA, 29-31 Jul 1985) | | | |
| 2 | *See* SAND-85-1687C | E 1.99: DE85017428 | MN -25 | 10:46758 |
| 3 | *See* LA-UR-85-2833 | E 1.99: DE85017566 | MN -4 | 10:46865 |
| CONF-850787- | (Multiple scattering of waves in random media and random rough surfaces, University Park, PA, USA, 29 Jul-1 Aug 1985) | | | |
| 1 | *See* UCRL-92358 | E 1.99: DE85016608 | MN -34 | 10:47461 |
| CONF-850807- | (6. international symposium on polarization phenomena in nuclear physics, Osaka, Japan, 26-30 Aug 1985) | | | |
| 3 | *See* LBL-19827 | E 1.99: DE85016639 | MN -34C | 10:47846 |
| CONF-850808- | (20. intersociety energy conversion engineering conference, Miami Beach, FL, USA, 18-23 Aug 1985) | | | |
| 17 | *See* DOE/NASA/12726-25 | E 1.99: DE85013034 | STD -94c | 10:46592 |
| 18 | NTIS, PC A02/MF A01; 1 (GPO Dep.) | E 1.99: DE85016313 | MN -94a | 10:46645 |
| 21 | *See* PNL-SA-13104 | E 1.99: DE85017863 | MN -61D | 10:46253 |
| CONF-850809- | (8. international conference on structural mechanics in reactor technology, Brussels, Belgium, 19-23 Aug 1985) | | | |
| 75 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: DE85016310 | MN -77 | 10:46457 |
| 76 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: DE85016311 | MN -80 | 10:46458 |
| CONF-850810- | (National heat transfer conference, Denver, CO, USA, 4-7 Aug 1985) | | | |
| 12 | *See* EGG-M-03985 | TI85008003 | MN -78 | 10:46509 |
| 25 | NTIS, PC A02/MF A01; 1 (GPO Dep.) | E 1.99: DE85016312 | MN -78 | 10:46466 |
| CONF-850814- | (Cryogenic engineering conference and international cryogenic materials conference, Boston, MA, USA, 12-16 Aug 1985) | | | |
| 2 | *See* UCRL-93132 | E 1.99: DE85016523 | STD -20b | 10:46761 |
| CONF-850836- | (American Institute of Chemical Engineers national meeting, Seattle, WA, USA, 25-28 Aug 1985) | | | |
| 5 | NTIS, PC A03/MF A01; 1 (GPO Dep.) | E 1.99: DE85014622 | MN -93A | 10:46635 |
| 6 | *See* MLM-3288(OP) | E 1.99: DE85017422 | MN -45 | 10:47183 |

| Report Number | Availability Source | File Number | Distribution Category | Abstract Number |
|---|---|---|---|---|
| CONF-850840- | (Joint meeting of the Electron Microscopy Society of America and the Microbeam Analysis Society, Louisville, KY, USA, 5-9 Aug 1985) | | | |
| 15 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: DE85016598 | MN -25 | 10:46828 |
| 16 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: DE85016596 | MN -25 | 10:46799 |
| CONF-850842- | (International conference on parallel processing, St. Charles, IL, USA, 20-23 Aug 1985) | | | |
| 2-Rev. | *See* LA-UR-85-1391-Rev. | DE85015691 | MN -32 | 10:47987 |
| CONF-850871- | (International conference on neutron scattering, Santa Fe, NM, USA, 19-24 Aug 1985) | | | |
| 5 | NTIS, PC A03/MF A01 (GPO Dep.) | E 1.99: DE85016479 | MN -25 | 10:46722 |
| 6 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: DE85016294 | MN -34 | 10:47855 |
| CONF-850878- | (AR and TD direct utilization contractors' meeting, Morgantown, WV, USA, 13-15 Aug 1985) | | | |
| 5 | *See* UCRL-92992 | E 1.99: DE85017267 | MN -90i | 10:46042 |
| CONF-850883- | (19. international cosmic ray conference, La Jolla, CA, USA, 11-23 Aug 1985) | | | |
| 8 | *See* SAND-85-1522C | E 1.99: DE85015815 | MN -34B | 10:47476 |
| CONF-850885- | (1. annual AFCEA symposium and exposition on physical and electronic security, Philadelphia, PA, USA, 19-21 Aug 1985) | | | |
| 5 | *See* SAND-85-1874C | E 1.99: DE85017110 | MN -15 | 10:46235 |
| CONF-850887- | (SPIE international technical symposium on optical and electro-optical engineers, San Diego, CA, USA, 18-23 Aug 1985) | | | |
| 20 | *See* UCRL-92198 | E 1.99: DE85016946 | MN -37 | 10:47164 |
| 21 | *See* SAND-85-1775C | E 1.99: DE85017120 | MN -21 | 10:47951 |
| 22 | *See* EGG-10282-2062 | E 1.99: DE85016567 | MN -37 | 10:47138 |
| 23 | *See* SAND-85-0354C | E 1.99: DE85016580 | MN -38 | 10:47161 |
| 24 | *See* SERI/TP-255-2791 | E 1.99: DE85012171 | MN -62 | 10:46350 |
| 25 | *See* SERI/TP-255-2771 | E 1.99: DE85012170 | MN -62 | 10:47163 |
| 34 | *See* LBL-19174 | E 1.99: DE85017654 | MN -95d | 10:46641 |
| CONF-8508101- | (11. annual underground coal gasification, Denver, CO, USA, 11-14 Aug 1985) | | | |
| 2 | *See* SAND-85-0924C | E 1.99: DE85017000 | MN -90c | 10:45957 |
| 3 | *See* UCRL-92488 | E 1.99: DE85017101 | MN -90c | 10:45960 |
| CONF-8508102- | (Conference on fiber optic couplers, connectors, and splice technology II, San Diego, CA, USA, 18-23 Aug 1985) | | | |
| 1 | *See* EGG-10282-1087 | E 1.99: DE85016787 | MN -38 | 10:46917 |
| CONF-8508104- | (Application of thin filmed multilayered structures to figured x-ray optics, San Diego, CA, USA, 18-23 Aug 1985) | | | |
| 1 | *See* LA-UR-85-2349 | E 1.99: DE85015679 | MN -37 | 10:46963 |
| CONF-8508106- | (CSNI specialist meeting on continuous monitoring techniques for assuring coolant circuit integrity, London, England, 12-14 Aug 1985) | | | |
| 1 | NTIS, PC A02/MF A01 - GPO | TI85016606 | MN -80 | 10:46504 |
| CONF-8508107- | (International seminar on solute defect interaction: theory and experiment, Kingston, Ontario, Canada, 5-9 Aug 1985) | | | |
| 1 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: DE85016605 | MN -25 | 10:46725 |
| CONF-8508108- | (2. international meeting on metallonthionein, Zurich, Switzerland, 21-24 Aug 1985) | | | |
| 2 | *See* LA-UR-85-2944 | E 1.99: DE85017546 | MN -48 | 10:47427 |
| CONF-8508109- | (Canadian Medical Association annual meeting, Ottawa, Canada, 21-23 Aug 1985) | | | |
| 1 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: DE85017304 | MN -41 | 10:47425 |
| CONF-8508110- | (TPSS review meeting, Boston, MA, USA, 12-13 Aug 1985) | | | |
| 1 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: DE85017314 | MN -20 | 10:47933 |
| CONF-8508111- | (National conference on energy program evaluation, Chicago, IL, USA, 19-21 Aug 1985) | | | |
| 1 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: DE85016477 | MN -95d | 10:46649 |
| 2 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: DE85016478 | MN -95d | 10:46650 |
| CONF-8508113- | (International symposium on antennas and EM theory, Beijing, China, 25-27 Aug 1985) | | | |
| 1 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: DE85016292 | MN -20g | 10:47900 |
| CONF-8508115- | (American Statistical Association for joint statistical meetings, Las Vegas, NV, USA, 5-8 Aug 1985) | | | |
| 1 | NTIS, PC A02; 3 | DE85017070 | MN -32 | 10:47970 |
| 2 | *See* SAND-85-1736C | TI85016164 | MN -70 | 10:46201 |
| CONF-8508116- | (2. national summer school on cryobiology and freeze-drying, Toulbuchin, Belgaria, 1-10 Aug 1985) | | | |
| 1 | NTIS, PC A02/MF A01; 1 (GPO Dep.) | E 1.99: DE85016297 | MN -48 | 10:47400 |
| CONF-8508118- | (34. Denver X-ray conference, Denver, CO, USA, 1 Aug 1985) | | | |
| 1 | *See* LA-UR-85-2920 | E 1.99: DE85017550 | MN -25 | 10:46743 |
| 2 | *See* MLM-3289(OP) | E 1.99: DE85017423 | MN -10 | 10:46164 |
| CONF-8508119- | (NATO advanced study institute: advances in chemical reaction dynamics, Iraklion, Crete, 25 Aug-7 Sep 1985) | | | |
| 1 | *See* LA-UR-85-2964 | E 1.99: DE85017543 | MN -45 | 10:47182 |

| Report Number | Availability Source | File Number | | Distribution Category | Abstract Number |
|---|---|---|---|---|---|
| CONF-850902- | (2. international symposium on environmental degradation of materials in nuclear power systems--water reactors, Monterey, CA, USA, 9-12 Sep 1985) | | | | |
| 4 | *See* PNL-SA-12996 | E 1.99: | DE85017911 | MN -25 | 10:46752 |
| CONF-850903- | (International topical meeting on computer applications for nuclear power plant operation and control, Pasco, WA, USA, 8-12 Sep 1985) | | | | |
| 9 | NTIS, PC A02/MF A01 - GPO | | TI85017078 | MN -80 | 10:46502 |
| CONF-850905- | (ENERSTOCK '85 - international conference on energy storage for building heating and cooling, Toronto, Canada, 22-26 Sep 1985) | | | | |
| 2 | *See* UCRL-92832 | E 1.99: | DE85014175 | MN -94a | 10:46590 |
| 3 | *See* LBL-19645 | E 1.99: | DE85014524 | MN -94a | 10:46588 |
| 4 | *See* LBL-19644 | E 1.99: | DE85014531 | MN -94a | 10:46587 |
| CONF-850918- | (International topical meeting on high level nuclear waste disposal - technology and engineering, Pasco, WA, USA, 24-26 Sep 1985) | | | | |
| 5 | *See* DP-MS-85-13 | E 1.99: | DE85016452 | MN -70 | 10:46176 |
| 6 | NTIS, PC A02/MF A01; 1 (GPO Dep.) | E 1.99: | DE85017080 | MN -70 | 10:46172 |
| 7 | *See* SAND-85-1359C | E 1.99: | DE85017370 | MN -70 | 10:46924 |
| CONF-850928- | (International symposium on contribution of materials investigation to the resolution of problems encountered in PWR plants, Chinon, France, 3-5 Sep 1985) | | | | |
| 1 | *See* BNL-NUREG-36717 | | TI85014824 | MN -78 | 10:46409 |
| CONF-850943- | (5. international conference on heavy metals in the environment, Athens, Greece, 10-13 Sep 1985) | | | | |
| 4 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: | DE85017001 | MN -11 | 10:47274 |
| CONF-850947- | (International meeting on solvent extraction and ion exchange in the nuclear fuel cycle, Harwell, UK, 3-6 Sep 1985) | | | | |
| 3 | NTIS, PC A02/MF A01; 1 (GPO Dep.) | E 1.99: | DE85017090 | MN -86 | 10:46430 |
| CONF-850953- | (3. symposium on containment of underground nuclear explosions, Idaho Falls, ID, USA, 10-12 Sep 1985) | | | | |
| 3 | *See* SAND-85-0788C | E 1.99: | DE85017371 | MN -35 | 10:47186 |
| CONF-850981- | (International symposium on coupled processes affecting the performance of a nuclear waste repository, Berkeley, CA, USA, 18-20 Sep 1985) | | | | |
| 3 | *See* LA-UR-85-3102 | E 1.99: | DE85017525 | MN -70 | 10:47281 |
| 4 | *See* LA-UR-85-2929 | E 1.99: | DE85017547 | MN -70B | 10:46186 |
| CONF-850995- | (Materials Research Society international symposium, Stockholm, Sweden, 9-12 Sep 1985) | | | | |
| 2 | *See* LA-UR-85-2929 | E 1.99: | DE85017547 | MN -70B | 10:46186 |
| CONF-850996- | (29. Human Factors Society annual meeting, Baltimore, MD, USA, 30 Sep-4 Oct 1985) | | | | |
| 3 | NTIS, PC A02/MF A01 - GPO | | TI85017081 | MN -80 | 10:46503 |
| 4 | NTIS, PC A02/MF A01 | | TI85017082 | MN -80 | 10:46474 |
| CONF-8509121- | (7. annual DOE LLWMP participants information meeting, Las Vegas, NV, USA, 10-13 Sep 1985) | | | | |
| 1 | *See* DP-MS-85-81 | E 1.99: | DE85017251 | MN -70 | 10:46210 |
| 5 | *See* PNL-SA-13315 | E 1.99: | DE85017914 | MN -70B | 10:46216 |
| CONF-8509126- | (Hot humid climate conference, College Park, TX, USA, 24-26 Sep 1985) | | | | |
| 2 | *See* LBL-19818 | E 1.99: | DE85017670 | MN -95d | 10:46664 |
| CONF-8509132- | (Deburring and surface conditioning conference, Chicago, IL, USA, 26 Sep 1985) | | | | |
| 1 | *See* BDX-613-3317 | E 1.99: | DE85015760 | MN -38 | 10:46916 |
| CONF-8509133- | (International conference on rare earth-development and applications, Beijing, China, 10-14 Sep 1985) | | | | |
| 1 | *See* IS-M-549 | E 1.99: | DE85015523 | MN -34A | 10:47512 |
| CONF-8509134- | (Cryogenic engineering conference, Cambridge, MA, USA, 13 Sep 1985) | | | | |
| 1 | *See* FNAL-TM-1334 | | DE85016987 | STD -38 | 10:46918 |
| CONF-8509135- | (1022/1032 users conference, Boston, MA, USA, 22-25 Sep 1985) | | | | |
| 1 | *See* K/CSD/INF-85/8 | E 1.99: | DE85016304 | MN -32 | 10:47964 |
| CONF-8509136- | (8. international conference on vacuum art metallurgy, Linz, Austria, 30 Sep-4 Oct 1985) | | | | |
| 1 | *See* SAND-85-1509C | E 1.99: | DE85016458 | MN -25 | 10:46757 |
| CONF-8509138- | (6. international symposium on inhaled particles, Cambridge, MA, USA, 1 Sep 1985) | | | | |
| 1 | *See* LA-UR-85-2553 | E 1.99: | DE85015695 | MN -48 | 10:47426 |
| 2 | *See* BNL-36841 | E 1.99: | DE85017514 | MN -41 | 10:47308 |
| CONF-8509139- | (International symposium on limitations of tactical nuclear modeling at the Royal Military College of Science, Shrivenham, Swindon, Wilt, UK, 2-6 Sep 1985) | | | | |
| 1 | *See* UCRL-93137 | E 1.99: | DE85017274 | MN -2 | 10:47994 |
| CONF-8509142- | (Geothermal program review, Washington, DC, USA, 11-12 Sep 1985) | | | | |
| 1 | *See* SAND-85-1866C | E 1.99: | DE85017231 | MN -66c | 10:46385 |
| CONF-8509143- | (Yamada conference on electronic properties of two-dimensional systems, Kyoto, Japan, 9-13 Sep 1985) | | | | |
| 1 | *See* UCRL-93152 | E 1.99: | DE85016948 | MN -34 | 10:47888 |

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|---|---|---|---|---|
| **CONF-8509147-** | (ACTINIDES '85, Aix-en-Provence, France, 1-6 Sep 1985) | | | |
| 1 | *See* LA-UR-85-3111 | E 1.99: DE85017524 | MN -10 | 10:46897 |
| 2 | *See* LA-UR-85-3112 | E 1.99: DE85017523 | MN -4 | 10:46898 |
| **CONF-8509148-** | (TRIUMF accelerated radioactive beams workshop, Parksvill, BC, Canada, 4-7 Sep 1985) | | | |
| 1 | *See* LA-UR-85-3098 | E 1.99: DE85017526 | MN -34B | 10:47845 |
| **CONF-8509150-** | (NATO advanced study institute, San Mianiato, Italy, 2-13 Sep 1985) | | | |
| 1 | *See* LA-UR-85-2902 | E 1.99: DE85017554 | MN -25 | 10:46742 |
| **CONF-8509153-** | (2. SP-100 program integration meeting, Denver, CO, USA, 17-19 Sep 1985) | | | |
| 1 | *See* LA-UR-85-3005 | E 1.99: DE85017337 | MN -33 | 10:46434 |
| **CONF-851002-** | (8. world energy engineering congress, Atlanta, GA, USA, 22-27 Oct 1985) | | | |
| 1 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: DE85013669 | MN -95 | 10:46640 |
| 2 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: DE85013668 | MN -94 | 10:46646 |
| **CONF-851003-** | (Conference on coal science, Sydney, Australia, 28 Oct-1 Nov 1985) | | | |
| 4 | *See* SAND-85-7200C | E 1.99: DE85012839 | MN -90d | 10:45958 |
| 5 | *See* DOE/FE/60181-116 | E 1.99: DE85013126 | MN -90 | 10:45968 |
| **CONF-851007-** | (3. international meeting on reactor thermal hydraulics, Newport, RI, USA, 15-18 Oct 1985) | | | |
| 1 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: DE85005032 | MN -79 | 10:46431 |
| **CONF-851029-** | (IMOG subgroup meeting, Livermore, CA, USA, 8-9 Oct 1985) | | | |
| 1 | *See* SAND-84-1739C | E 1.99: DE85007107 | MN -25 | 10:46967 |
| **CONF-851030-** | (SOLAR '85, Raleigh, NC, USA, 15-20 Oct 1985) | | | |
| 2 | *See* LA-UR-85-2845 | E 1.99: DE85017562 | MN -59B | 10:46368 |
| 3 | *See* LA-UR-85-2844 | E 1.99: DE85017563 | MN -59B | 10:46367 |
| 4 | *See* LA-UR-85-2913 | E 1.99: DE85017552 | MN -59B | 10:46369 |
| 5 | *See* LA-UR-85-2914 | E 1.99: DE85017551 | MN -59B | 10:46370 |
| **CONF-851039-** | (American Society of Civil Engineers fall meeting, Detroit, MI, USA, 1 Oct 1985) | | | |
| 1 | *See* SAND-84-2244C | E 1.99: DE85008410 | MN -25 | 10:47459 |
| **CONF-851045-** | (Instrument Society of America international conference and exhibit, Philadelphia, PA, USA, 21-24 Oct 1985) | | | |
| 1 | *See* EGG-M-11685 | E 1.99: DE85014582 | MN -37 | 10:46911 |
| **CONF-851048-** | (168. meeting of the Electrochemical Society, Las Vegas, NV, USA, 13-18 Oct 1985) | | | |
| 3 | *See* SAND-85-7197C | DE85011711 | MN -94cb | 10:46598 |
| 4 | *See* LA-UR-85-3084 | E 1.99: DE85017528 | MN -10 | 10:46187 |
| 5 | *See* LA-UR-85-2805 | E 1.99: DE85017568 | MN -70 | 10:46739 |
| **CONF-851054-** | (Society of Mining Engineers fall meeting, Albuquerque, NM, USA, 16-18 Oct 1985) | | | |
| 3 | *See* UCRL-92423 | E 1.99: DE85016439 | MN -11 | 10:47452 |
| **CONF-851071-** | (IEEE-Industry Applications Society annual meeting, Toronto, Ontario, Canada, 6-11 Oct 1985) | | | |
| 2 | *See* ANL-HEP-CP-85-61 | E 1.99: DE85013854 | MN -94 | 10:46577 |
| 3 | *See* LBL-19779 | E 1.99: DE85017648 | MN -95 | 10:46663 |
| 4 | *See* LBL-19778 | E 1.99: DE85017647 | MN -95 | 10:46662 |
| **CONF-851074-** | (International battery testing workshop, Heidelberg, F.R. Germany, 1-3 Oct 1985) | | | |
| 1 | *See* SAND-85-7216C | E 1.99: DE85016996 | MN -94cb | 10:46599 |
| **CONF-851096-** | (International conference on non-linear mechanics, Shanghai, China, 28-31 Oct 1985) | | | |
| 1 | *See* UCRL-92301 | E 1.99: DE85012945 | MN -38 | 10:47993 |
| **CONF-851098-** | (International fire safety meeting, Gaithersburg, MD, USA, 7 Oct 1985) | | | |
| 1 | *See* UCRL-92070 | TI85013822 | MN -78 | 10:46573 |
| **CONF-8510114-** | (Conference on electrical insulation and dielectrics, Amherst, NY, USA, 21-25 Oct 1985) | | | |
| 1 | *See* SAND-85-0723C | E 1.99: DE85014640 | MN -38 | 10:47135 |
| **CONF-8510115-** | (American Concrete Institute fall meeting on polymers in concrete, Chicago, IL, USA, 3-4 Oct 1985) | | | |
| 1 | *See* BNL-36465 | E 1.99: DE85014825 | MN -25 | 10:46788 |
| **CONF-8510116-** | (Autotestcon conference, Long Island, NY, USA, 22-24 Oct 1985) | | | |
| 1 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: DE85014998 | MN -32 | 10:47971 |
| **CONF-8510118-** | (DOE natural phenomena hazards mitigation conference, Las Vegas, NV, USA, 7-11 Oct 1985) | | | |
| 1 | *See* RFP-3821 | E 1.99: DE85016113 | MN -15 | 10:46222 |
| 4 | *See* EGG-M-09985 | DE85017474 | MN -11 | 10:47448 |
| 5 | *See* UCRL-93226 | E 1.99: DE85017699 | MN -41 | 10:46972 |
| **CONF-8510146-** | (International astronautical federation congress, Stockholm, Sweden, 7-12 Oct 1985) | | | |
| 1 | *See* UCRL-93154 | E 1.99: DE85017102 | MN -34B | 10:47480 |
| **CONF-8510148-** | (Korea-U.S.A. coal utilization technology workshop, Seoul, Korea, 14-19 Oct 1985) | | | |
| 1 | *See* DOE/FE/60181-165 | E 1.99: DE85017463 | MN -90c | 10:45941 |
| **CONF-8510149-** | (Westinghouse engineering computer applications symposium, Monroeville, PA, USA, 7-8 Oct 1985) | | | |
| 1 | *See* WAPD-T-2867 | E 1.99: DE85017632 | MN -38 | 10:46949 |

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|---|---|---|---|---|---|
| 2 | *See* WAPD-T-2865 | E 1.99: | DE85017631 | MN -38 | 10:46948 |
| 3 | *See* WAPD-T-2869 | | DE85017634 | MN -38 | 10:46915 |
| **CONF-851177-** | (7. symposium on turbulence and diffusion of the AMS, Boulder, CO, USA, 12-15 Nov 1985) | | | | |
| 2 | *See* LA-UR-85-2887 | E 1.99: | DE85017555 | MN -91 | 10:47234 |
| **CONF-851201-** | (7. Miami international conference on alternative energy sources, Miami Beach, FL, USA, 9-11 Dec 1985) | | | | |
| 1 | *See* SAND-85-1914C | E 1.99: | DE85017372 | MN -66a | 10:46382 |
| **COO-** | | | | | |
| 1195-499 | *See* DOE/ER/01195-T7 | E 1.99: | DE85016191 | MN -34D | 10:47552 |
| 4957-5 | *See* DOE/EV/04957-5 | E 1.99: | DE85017601 | MN -48 | 10:47064 |
| 6411-1-Vol.1 | *See* UE/C-ANL-810930-Vol.1 | E 1.99: | DE85016735 | MN -13 | 10:46611 |
| **CRN-HE-** | | | | | |
| 84-03 | NTIS (US Sales Only), PC A02/MF A01 | | DE85752150 | MN -34D | 10:47577 |
| 84-05 | NTIS (US Sales Only), PC A02/MF A01 | | DE85752148 | MN -34D | 10:47578 |
| 84-08 | NTIS (US Sales Only), PC A03/MF A01 | | DE85752147 | MN -34D | 10:47579 |
| 84-09 | NTIS (US Sales Only), PC A02/MF A01 | | DE85752149 | MN -34D | 10:47580 |
| **CTH-JVG-** | | | | | |
| 14 | NTIS (US Sales Only), PC A03/MF A01; 1 | | DE85752521 | MN -94a | 10:46582 |
| **CTH-RF-** | | | | | |
| 46 | NTIS (US Sales Only), PC A05/MF A01 | | DE85702168 | MN -80 | 10:46445 |
| **DESY-** | | | | | |
| 85-020 | NTIS (US Sales Only), PC A03/MF A01 | | DE85752322 | MN -34D | 10:47551 |
| 85-028 | NTIS (US Sales Only) | | DE85752239 | MN -34D | 10:47628 |
| 85-030 | NTIS (US Sales Only), PC A02/MF A01 | | DE85752321 | MN -34D | 10:47581 |
| 85-035 | NTIS (US Sales Only), PC A02/MF A01 | | DE85752324 | MN -34D | 10:47629 |
| 85-036 | NTIS (US Sales Only), PC A02/MF A01 | | DE85752325 | MN -34D | 10:47582 |
| 85-038 | NTIS (US Sales Only), PC A02/MF A01 | | DE85752323 | MN -28 | 10:47062 |
| **DFVLR-FB-** | | | | | |
| 85-25 | NTIS (US Sales Only), PC A05/MF A01; 1 | | DE85752701 | MN -90i | 10:47208 |
| **DOE/BC/10749-** | | | | | |
| 3 | NTIS, PC A07/MF A01; 1 (GPO Dep.) | E 1.99: | DE85017994 | MN -92b | 10:46063 |
| **DOE/BP-** | | | | | |
| 242 | NTIS, PC A03/MF A01 (GPO Dep.) | E 1.99: | DE85017285 | MN -11 | 10:46268 |
| **DOE/BP/11797-** | | | | | |
| 2 | NTIS, PC A08/MF A01; 1 (GPO Dep.) | E 1.99: | DE85017331 | MN -11 | 10:47298 |
| **DOE/BP/13084-** | | | | | |
| 1 | NTIS, PC A04/MF A01 (GPO Dep.) | E 1.99: | DE85017462 | MN -11 | 10:47331 |
| **DOE/BP/16479-** | | | | | |
| 1 | NTIS, PC A04/MF A01; 1 (GPO Dep.) | E 1.99: | DE85017377 | MN -48 | 10:47328 |
| **DOE/BP/35097-** | | | | | |
| 2 | NTIS, PC A06/MF A01; 1 (GPO Dep.) | E 1.99: | DE85016236 | MN -11 | 10:47299 |
| **DOE/BP/35346-** | | | | | |
| 1 | NTIS, PC A05/MF A01 (GPO Dep.) | E 1.99: | DE85017432 | MN -11 | 10:46269 |
| **DOE/CE/15195-** | | | | | |
| T1 | NTIS, PC A03/MF A01; 1 (GPO Dep.) | E 1.99: | DE85014426 | MN -94e | 10:46583 |
| T2 | NTIS, PC A02/MF A01; 1 (GPO Dep.) | E 1.99: | DE85014427 | MN -94e | 10:46584 |
| **DOE/CH-** | | | | | |
| 10140-3(85-1) | NTIS, PC A06/MF A01 (GPO Dep.) | E 1.99: | DE85017696 | STD -70 | 10:46173 |
| **DOE/CS/20485-** | | | | | |
| T1 | NTIS, PC A16/MF A01; 1 (GPO Dep.) | E 1.99: | DE85017220 | MN -95 | 10:46651 |
| **DOE/CS/30261-** | | | | | |
| T1 | NTIS, PC A09/MF A01; 1 (GPO Dep.) | E 1.99: | DE85010196 | MN -59B | 10:46353 |
| **DOE/CS/30630-** | | | | | |
| T1 | NTIS, PC A04/MF A01 (GPO Dep.) | E 1.99: | DE85017408 | MN -59A | 10:46275 |
| **DOE/CS/40521-** | | | | | |
| T1 | NTIS, PC A12/MF A01; 1 (GPO Dep.) | E 1.99: | DE85016803 | STD -95f | 10:46905 |
| **DOE/DR/00789-** | | | | | |
| T13 | NTIS MF A01; 2 (GPO Dep.) | E 1.99: | DE85017185 | MN -62 | 10:46348 |
| **DOE/EI/19683-** | | | | | |
| T1 | NTIS, PC A02/MF A01; 1 (GPO Dep.) | E 1.99: | DE85017664 | MN -98B | 10:46616 |
| **DOE/EI/19686-** | | | | | |
| T1 | NTIS, PC A02/MF A01; 1 (GPO Dep.) | E 1.99: | DE85017571 | MN -98B | 10:46617 |
| **DOE/EI/19692-** | | | | | |
| T1 | NTIS, PC A02/MF A01; 1 (GPO Dep.) | E 1.99: | DE85017663 | MN -98B | 10:46618 |
| **DOE/EIA-** | | | | | |
| 0035(85/ 05) | NTIS, PC A07/MF A01; 1 - GPO (GPO Dep.) | E 1.99: | DE85017236 | MN -98 | 10:46627 |
| 0130(85/ 06) | NTIS, PC A08/MF A01; 1 - GPO (GPO Dep.) | E 1.99: | DE85017382 | MN -98C | 10:46077 |
| 0348(84) | NTIS, PC A08/MF A01 - GPO (GPO Dep.) | E 1.99: | DE85017935 | MN -98E | 10:46622 |
| 0476 | NTIS, PC A03/MF A01; 1 (GPO Dep.) | E 1.99: | DE85018010 | MN -98E | 10:46623 |
| **DOE/ER-** | | | | | |
| 0042/ 3-Rev.8-85 | NTIS, PC A02/MF A01; 1 (GPO Dep.) | E 1.99: | DE85017457 | STD -13 | 10:47958 |
| 0156/ 3 | NTIS, PC A03/MF A01 (GPO Dep.) | E 1.99: | DE85017506 | MN -11 | 10:47278 |
| 0246 | NTIS, PC A04/MF A01 (GPO Dep.) | E 1.99: | DE85017978 | MN -11 | 10:47258 |
| **DOE/ER/01195-** | | | | | |
| T7 | NTIS, PC A07/MF A01 (GPO Dep.) | E 1.99: | DE85016191 | MN -34D | 10:47552 |
| **DOE/ER/03077-** | | | | | |
| 266 | NTIS, PC A03/MF A01 (GPO Dep.) | E 1.99: | DE85017393 | MN -32 | 10:47530 |
| **DOE/ER/03509-** | | | | | |
| 21 | NTIS, PC A06/MF A01; 1 (GPO Dep.) | E 1.99: | DE85016901 | MN -34D | 10:47553 |
| **DOE/ER/04426-** | | | | | |
| 8 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: | DE85017167 | MN -4 | 10:46860 |

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|---|---|---|---|---|---|
| DOE/ER/05173-T1 | NTIS, PC A03/MF A01; 1 (GPO Dep.) | E 1.99: | DE85017210 | MN -4 | 10:46831 |
| DOE/ER/10157-1 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: | DE85017192 | MN -91 | 10:46092 |
| DOE/ER/10344-5 | NTIS, PC A03/MF A01; 1 (GPO Dep.) | E 1.99: | DE85017166 | MN -34C | 10:47782 |
| DOE/ER/10701-T2 | NTIS, PC A03/MF A01 (GPO Dep.) | E 1.99: | DE85010686 | MN -48 | 10:46308 |
| T3 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: | DE85017619 | MN -61 | 10:46309 |
| DOE/ER/10713-6B | NTIS, PC A02/MF A01; 1 (GPO Dep.) | E 1.99: | DE85017190 | MN -34D | 10:47063 |
| DOE/ER/10816-T1 | NTIS, PC A04/MF A01; 1 (GPO Dep.) | E 1.99: | DE85017627 | MN -25 | 10:46726 |
| DOE/ER/10823-T1 | NTIS, PC A10/MF A01 (GPO Dep.) | E 1.99: | DE85017941 | MN -91 | 10:46093 |
| DOE/ER/10968-3 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: | DE85017606 | MN -90a | 10:46032 |
| DOE/ER/13005-1 | NTIS, PC A02/MF A01; 1 (GPO Dep.) | E 1.99: | DE85017047 | MN -4 | 10:46876 |
| DOE/ER/13121-T1 | NTIS, PC A05/MF A01; 1 (GPO Dep.) | E 1.99: | DE85015287 | MN -32 | 10:47881 |
| DOE/ER/13127-05 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: | DE85017414 | MN -48 | 10:46832 |
| DOE/ER/13323-1 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: | DE85017707 | MN -4 | 10:46877 |
| DOE/ER/40105-480 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: | DE85012589 | MN -34D | 10:47583 |
| DOE/ER/40124-5 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: | DE85017418 | MN -28 | 10:46993 |
| 6 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: | DE85017419 | MN -28 | 10:46994 |
| DOE/ER/45114-1 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: | DE85017986 | MN -25 | 10:46792 |
| DOE/ER/45135-12 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: | DE85016841 | MN -34 | 10:47882 |
| DOE/ER/60031-T1 | NTIS, PC A15/MF A01; 1 (GPO Dep.) | E 1.99: | DE85013666 | MN -11 | 10:47262 |
| DOE/ER/60118-T1 | NTIS, PC A03/MF A01 (GPO Dep.) | E 1.99: | DE85017970 | MN -48 | 10:47368 |
| DOE/ER/60197-6 | NTIS, PC A03/MF A01; 1 (GPO Dep.) | E 1.99: | DE85017431 | MN -11 | 10:47439 |
| DOE/ER/60297-1 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: | DE85017618 | MN -48 | 10:47259 |
| DOE/ER/75172-2 | NTIS, PC A03; 3 | | DE85016926 | MN -2 | 10:47856 |
| 3 | NTIS, PC A03/MF A01; 1 (GPO Dep.) | E 1.99: | DE85016927 | MN -2 | 10:46443 |
| DOE/ET/10069-T116 | NTIS (US Sales Only), PC A13/MF A01; 1 (GPO Dep.) | E 1.99: | DE85017113 | STD -90d | 10:45933 |
| DOE/ET/10532-T26 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: | DE85017111 | STD -90d | 10:45934 |
| DOE/ET/10592-T1 | NTIS, PC A04/MF A01; 1 (GPO Dep.) | E 1.99: | DE85017622 | MN -90d | 10:45935 |
| T2 | NTIS, PC A03/MF A01; 1 (GPO Dep.) | E 1.99: | DE85017623 | MN -90d | 10:45936 |
| T3 | NTIS, PC A04/MF A01; 1 (GPO Dep.) | E 1.99: | DE85017625 | MN -90d | 10:45965 |
| T4 | NTIS, PC A03/MF A01; 1 (GPO Dep.) | E 1.99: | DE85017624 | MN -90d | 10:45937 |
| T5 | NTIS, PC A04/MF A01; 1 (GPO Dep.) | E 1.99: | DE85017626 | MN -90d | 10:45966 |
| DOE/ET/12227-T1 | NTIS, PC A02; 3 | | DE85017609 | MN -93A | 10:46636 |
| DOE/ET/13378-T1 | NTIS, PC A05/MF A01; 1 (GPO Dep.) | E 1.99: | DE85017621 | MN -90d | 10:45967 |
| DOE/ET/14700-T1-Vol.4 | NTIS, PC A08/MF A01 (GPO Dep.) | E 1.99: | DE85014169 | STD -90d | 10:45938 |
| T1-Vol.5 | NTIS, PC A12/MF A01 | | DE85014170 | STD -90d | 10:45939 |
| T1-Vol.8 | NTIS, PC A09/MF A01 (GPO Dep.) | E 1.99: | DE85014173 | STD -90d | 10:46247 |
| DOE/ET/17091-1864 | NTIS, PC A09/MF A01; 1 (GPO Dep.) | E 1.99: | DE85013605 | STD -90c | 10:46395 |
| DOE/ET/20026-T1 | NTIS, PC A02/MF A01; 1 (GPO Dep.) | E 1.99: | DE85017603 | MN -61A | 10:46310 |
| T2 | NTIS, PC A05/MF A01; 1 (GPO Dep.) | E 1.99: | DE85017604 | MN -61A | 10:46311 |
| DOE/ET/27019-1 | NTIS, PC A11/MF A01; 1 (GPO Dep.) | E 1.99: | DE85016911 | MN -66a | 10:46383 |
| DOE/ET/29032-T1 | NTIS, PC A09/MF A01; 1 (GPO Dep.) | E 1.99: | DE85016426 | MN -97 | 10:46391 |
| DOE/ET/34212-48 | NTIS (US Sales Only), PC A05/MF A01; 1 (GPO Dep.) | E 1.99: | DE85017703 | STD -78 | 10:46411 |
| DOE/EV/02364-21 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: | DE85017473 | MN -48 | 10:46890 |
| 22 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: | DE85017476 | MN -48 | 10:46891 |
| DOE/EV/04957-5 | NTIS, PC A03/MF A01; 1 (GPO Dep.) | E 1.99: | DE85017601 | MN -48 | 10:47064 |
| DOE/EV/05855-8 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: | DE85017187 | MN -48 | 10:46885 |

| Report Number | Availability Source | File Number | Distribution Category | Abstract Number |
|---|---|---|---|---|
| DOE/EV/10360-4 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: DE85017124 | MN -48 | 10:47329 |
| DOE/EV/10611-5 | NTIS, PC A05/MF A01 (GPO Dep.) | E 1.99: DE85017884 | STD -11 | 10:47270 |
| DOE/EV/10651-T1 | NTIS, PC A04/MF A01; 1 (GPO Dep.) | E 1.99: DE85017600 | MN -48 | 10:47312 |
| DOE/FC/10271-1875 | NTIS, PC A04/MF A01 (GPO Dep.) | E 1.99: DE85014363 | STD -90 | 10:46396 |
| DOE/FE-0049 | NTIS, PC A02/MF A01; 1 (GPO Dep.) | E 1.99: DE85017691 | MN -92 | 10:46071 |
| DOE/FE/05123-1879 | NTIS, PC A08/MF A01 (GPO Dep.) | E 1.99: DE85012192 | STD -90c | 10:45940 |
| DOE/FE/60181-116 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: DE85013126 | MN -90 | 10:45968 |
| 165 | NTIS, PC A03/MF A01; 1 (GPO Dep.) | E 1.99: DE85017463 | MN -90c | 10:45941 |
| DOE/ID-10132 | NTIS, PC A05/MF A01; 1 (GPO Dep.) | E 1.99: DE85017977 | STD -97e | 10:46266 |
| DOE/ID/01570-T99 | NTIS, PC A05/MF A01; 1 (GPO Dep.) | E 1.99: DE85017479 | MN -70 | 10:46174 |
| DOE/ID/12424-T1 | NTIS, PC A05/MF A01; 1 (GPO Dep.) | E 1.99: DE85017465 | MN -95f | 10:46906 |
| DOE/IR/10295-T3 | NTIS, PC A02/MF A01; 1 (GPO Dep.) | E 1.99: DE85016967 | MN -13 | 10:46605 |
| T4 | NTIS, PC A03/MF A01; 1 (GPO Dep.) | E 1.99: DE85016966 | MN -13 | 10:46606 |
| T5 | NTIS, PC A99/MF A01; 1 (GPO Dep.) | E 1.99: DE85016968 | MN -13 | 10:46607 |
| DOE/IR/10342-T1 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: DE85017333 | MN -59A | 10:46270 |
| DOE/JPL-1012-104 | NTIS, PC A99/MF A01; 1 (GPO Dep.) | E 1.99: DE85017592 | STD -63b | 10:46312 |
| 1060-88 | NTIS, PC A03/MF A01 (GPO Dep.) | E 1.99: DE85017590 | STD -62 | 10:46272 |
| DOE/JPL/956766-85/01 | NTIS, PC A10/MF A01; 1 (GPO Dep.) | E 1.99: DE85016575 | STD -63b | 10:46313 |
| DOE/JPL/956786-85/5 | NTIS, PC A03/MF A01 (GPO Dep.) | E 1.99: DE85017380 | STD -63b | 10:46314 |
| DOE/LC/10783-1866-Vol.3 | NTIS, PC A03/MF A01; 1 (GPO Dep.) | E 1.99: DE85007800 | STD -91 | 10:46094 |
| 1866-Vol.6 | NTIS, PC A10/MF A01 (GPO Dep.) | E 1.99: DE85007804 | STD -91 | 10:46095 |
| DOE/LC/10845-1828 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: DE85010073 | STD -92 | 10:46833 |
| DOE/MA-0062/3 | NTIS, PC A04/MF A01 (GPO Dep.) | E 1.99: DE85012772 | MN -13 | 10:47959 |
| 0083/1 | NTIS, PC A05/MF A01 (GPO Dep.) | E 1.99: DE85017335 | MN -13 | 10:47960 |
| DOE/MC/10761-1880 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: DE85013679 | MN -37 | 10:47137 |
| DOE/MC/14101-1847 | NTIS, PC A06/MF A01 (GPO Dep.) | E 1.99: DE85011277 | STD -90b | 10:45969 |
| DOE/MC/14322-1800 | NTIS, PC A12/MF A01; 1 (GPO Dep.) | E 1.99: DE85013685 | STD -90e | 10:46045 |
| DOE/MC/16471-1887 | NTIS, PC A06/MF A01 (GPO Dep.) | E 1.99: DE85013680 | STD -90c | 10:46397 |
| DOE/MC/16537-1764 | NTIS, PC A07/MF A01; 1 (GPO Dep.) | E 1.99: DE85013691 | MN -90c | 10:46046 |
| DOE/MC/19208-1891 | NTIS, PC A13/MF A01; 1 (GPO Dep.) | E 1.99: DE85013683 | STD -90c | 10:45942 |
| DOE/MC/19392-1826 | NTIS, PC A06/MF A01; 1 (GPO Dep.) | E 1.99: DE85013678 | STD -90i | 10:45977 |
| DOE/MC/20094-1729 | NTIS, PC A03/MF A01 (GPO Dep.) | E 1.99: DE85005660 | STD -93A | 10:46637 |
| DOE/MC/20107-T3 | NTIS, PC A02/MF A01; 1 (GPO Dep.) | E 1.99: DE85017221 | MN -90e | 10:46398 |
| DOE/MC/20110-1895 | NTIS, PC A11/MF A01; 1 (GPO Dep.) | E 1.99: DE85013684 | STD -90c | 10:45978 |
| DOE/MC/20417-1745 | NTIS, PC A03/MF A01 (GPO Dep.) | E 1.99: DE85007314 | STD -90c | 10:45943 |
| 1747 | NTIS, PC A04/MF A01 (GPO Dep.) | E 1.99: DE85007311 | STD -90c | 10:45944 |
| DOE/MC/20422-1873 | NTIS, PC A05/MF A01 (GPO Dep.) | E 1.99: DE85013606 | STD -92a | 10:46074 |
| DOE/MI/10027-T1 | NTIS, PC A06/MF A01; 1 (GPO Dep.) | E 1.99: DE85011240 | MN -13 | 10:47961 |
| DOE/NASA-4105-1 | NTIS, PC A03/MF A01 (GPO Dep.) | E 1.99: DE85017351 | STD -60 | 10:46387 |
| DOE/NASA/12726-25 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: DE85013034 | STD -94c | 10:46592 |
| DOE/NBM-5016660 | NTIS, PC A03/MF A01; 1 (GPO Dep.) | E 1.99: DE85016660 | MN -78 | 10:46402 |
| 5017505 | NTIS, PC A07/MF A01 - GPO (GPO Dep.) | E 1.99: DE85017505 | MN -98G | 10:46602 |
| DOE/NV/10185-1 | NTIS, PC A13/MF A01; 1 (GPO Dep.) | E 1.99: DE85016465 | MN -66a | 10:46384 |
| DOE/NV/10250-21 | NTIS, PC A03/MF A01 (GPO Dep.) | E 1.99: DE85017343 | MN -70 | 10:46175 |
| DOE/OR/20722-55 | NTIS, PC A04/MF A01; 1 (GPO Dep.) | E 1.99: DE85017612 | MN -11 | 10:46209 |
| 56 | NTIS, PC A03/MF A01 (GPO Dep.) | E 1.99: DE85017886 | MN -70A | 10:46218 |
| 57 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: DE85017887 | MN -70A | 10:46219 |

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|---|---|---|---|---|---|
| DOE/OR/21389- | | | | | |
| 5 | NTIS, PC A03/MF A01; 1 (GPO Dep.) | E 1.99: | DE85017988 | MN -61 | 10:46315 |
| 6 | NTIS, PC A02/MF A01; 1 (GPO Dep.) | E 1.99: | DE85017987 | MN -61 | 10:46631 |
| DOE/OR/21400- | | | | | |
| T169 | NTIS, PC A03/MF A01 (GPO Dep.) | E 1.99: | DE85016179 | MN -90h | 10:46727 |
| T171 | NTIS, PC A11/MF A01; 1 (GPO Dep.) | E 1.99: | DE85016178 | MN -90h | 10:46728 |
| T175 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: | DE85017976 | MN -95 | 10:46652 |
| DOE/PC/30229- | | | | | |
| 6 | NTIS, PC A03/MF A01 (GPO Dep.) | E 1.99: | DE85017254 | MN -90a | 10:46878 |
| DOE/PC/40077- | | | | | |
| T9 | NTIS, PC A14/MF A01; 1 (GPO Dep.) | E 1.99: | DE85017394 | MN -90d | 10:46248 |
| DOE/PC/50801- | | | | | |
| 11 | NTIS, PC A02/MF A01; 1 (GPO Dep.) | E 1.99: | DE85016251 | MN -90a | 10:45971 |
| DOE/PC/60047- | | | | | |
| T8 | NTIS, PC A03/MF A01; 1 (GPO Dep.) | E 1.99: | DE85017680 | STD -90d | 10:45945 |
| DOE/PC/60406- | | | | | |
| T3 | NTIS, PC A03/MF A01 (GPO Dep.) | E 1.99: | DE85017293 | MN -05 | 10:46619 |
| T4 | NTIS, PC A04/MF A01; 1 (GPO Dep.) | E 1.99: | DE85017292 | MN -05 | 10:46620 |
| DOE/PC/60779- | | | | | |
| 7 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: | DE85016903 | MN -90a | 10:46861 |
| DOE/PC/60800- | | | | | |
| 7 | NTIS, PC A02/MF A01; 1 (GPO Dep.) | E 1.99: | DE85017411 | MN -90c | 10:45946 |
| DOE/PC/70003- | | | | | |
| T5 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: | DE85016252 | MN -90d | 10:46037 |
| DOE/PC/70018- | | | | | |
| 9 | NTIS, PC A06/MF A01 (GPO Dep.) | E 1.99: | DE85017237 | STD -90d | 10:45947 |
| DOE/PC/70028- | | | | | |
| T3 | NTIS, PC A21/MF A01; 1 (GPO Dep.) | E 1.99: | DE85015537 | STD -90d | 10:46249 |
| DOE/PC/70509- | | | | | |
| T3 | NTIS, PC A08/MF A01 (GPO Dep.) | E 1.99: | DE85016429 | STD -90g | 10:46632 |
| DOE/PC/70754- | | | | | |
| T1 | NTIS, PC A02/MF A01 | | DE85017208 | MN -90a | 10:45972 |
| DOE/PC/70786- | | | | | |
| T3 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: | DE85016162 | MN -90d | 10:45950 |
| DOE/PC/70788- | | | | | |
| T2 | NTIS, PC A02/MF A01; 1 (GPO Dep.) | E 1.99: | DE85016646 | MN -90d | 10:46250 |
| DOE/PC/70790- | | | | | |
| T3 | NTIS, PC A02/MF A01; 1 (GPO Dep.) | E 1.99: | DE85016263 | MN -90b | 10:45951 |
| DOE/PC/70796- | | | | | |
| 4 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: | DE85016116 | MN -90a | 10:46038 |
| DOE/PC/71257- | | | | | |
| T3 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: | DE85016181 | MN -90d | 10:45952 |
| DOE/PC/79892- | | | | | |
| T3 | NTIS, PC A03; 3 | | DE85016920 | MN -90d | 10:45953 |
| DOE/PC/80752- | | | | | |
| T1 | NTIS, PC A04/MF A01; 1 (GPO Dep.) | E 1.99: | DE85017358 | MN -90e | 10:46047 |
| DOE/PE/70267- | | | | | |
| T39 | The Brookings Institution, 1775 Massachusetts Ave., NW, Washington, DC 20036 | | TI85016746 | ND -05 | 10:46615 |
| T47 | The Brookings Inst., 1775 Mass. Ave., NW, Washington, DC 20036 | | TI85016745 | ND -05 | 10:46609 |
| DOE/R3/06073- | | | | | |
| T1 | NTIS, PC A02; 3 | | DE85009198 | MN -61 | 10:46251 |
| DOE/R3/08090- | | | | | |
| T6 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: | DE85009690 | MN -59A | 10:46354 |
| DOE/SF/01974- | | | | | |
| T1 | NTIS MF A01; 2 (GPO Dep.) | E 1.99: | DE85013409 | MN -60 | 10:46388 |
| DOE/TIC- | | | | | |
| 4636-Rev.1 | NTIS, PC A13/MF A01 (GPO Dep.) | E 1.99: | DE85003233 | STD -05 | 10:46608 |
| DP-MS- | | | | | |
| 85-13 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: | DE85016452 | MN -70 | 10:46176 |
| 85-16A | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: | DE85016453 | MN -70 | 10:46177 |
| 85-16B | NTIS, PC A03/MF A01 (GPO Dep.) | E 1.99: | DE85017059 | MN -70 | 10:46178 |
| 85-81 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: | DE85017251 | MN -70 | 10:46210 |
| DPST- | | | | | |
| 85-376 | NTIS, PC A07/MF A01 (GPO Dep.) | E 1.99: | DE85017701 | MN -11 | 10:47297 |
| 85-377 | NTIS, PC A09/MF A01; 1 (GPO Dep.) | E 1.99: | DE85017702 | MN -11 | 10:47300 |
| DTH-LFK- | | | | | |
| F57-01 | NTIS (US Sales Only), PC A07/MF A01; 1 | | DE85752661 | MN -59A | 10:46355 |
| DTH-LV-MEDD- | | | | | |
| 152 | NTIS (US Sales Only), PC A05/MF A01 | | DE85752633 | MN -95d | 10:46653 |
| 154 | NTIS (US Sales Only), PC A06/MF A01; 1 | | DE85752640 | MN -94e | 10:46585 |
| 158 | NTIS (US Sales Only), PC A05/MF A01 | | DE85752632 | MN -59A | 10:46356 |
| 165 | NTIS (US Sales Only), PC A10/MF A01; 1 | | DE85752634 | MN -59B | 10:46357 |
| 168 | NTIS (US Sales Only), PC A04/MF A01; 1 | | DE85752658 | MN -62 | 10:46380 |
| DTH-LV-R- | | | | | |
| 84-32 | NTIS (US Sales Only), PC A05/MF A01 | | DE85752638 | MN -95d | 10:47972 |
| 84-33 | NTIS (US Sales Only), PC A03/MF A01 | | DE85752637 | MN -95d | 10:47973 |
| 85-6 | NTIS (US Sales Only), PC A04/MF A01 | | DE85752657 | MN -95f | 10:46693 |
| ECRC/M- | | | | | |
| 1859 | *See* PB-85-189538/XAB | | | | 10:46700 |
| ECS-SR- | | | | | |
| 18 | *See* DPST-85-377 | E 1.99: | DE85017702 | MN -11 | 10:47300 |
| 85-376 | *See* DPST-85-376 | E 1.99: | DE85017701 | MN -11 | 10:47297 |

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|---|---|---|---|---|---|
| **EEB-L-** | | | | | |
| 85-05 | *See* LBL-19779 | E 1.99: | DE85017648 | MN -95 | 10:46663 |
| 85-06 | *See* LBL-19778 | E 1.99: | DE85017647 | MN -95 | 10:46662 |
| **EEG-** | | | | | |
| 29 | NTIS, PC A04/MF A01; 1 (GPO Dep.) | E 1.99: | DE85016422 | MN -70 | 10:46179 |
| 30 | NTIS, PC A04/MF A01; 1 (GPO Dep.) | E 1.99: | DE85016423 | MN -70 | 10:46180 |
| 31 | NTIS MF A01; 2 (GPO Dep.) | E 1.99: | DE85016424 | MN -70 | 10:46181 |
| **EEV-** | | | | | |
| 81-04 | NTIS (US Sales Only), PC A06/MF A01; 1 | | DE85752629 | MN -60 | 10:46389 |
| **EFI-** | | | | | |
| 617(7) -83 | NTIS (US Sales Only), PC A02/MF A01 | | DE85702054 | MN -34A | 10:46800 |
| **EFN-** | | | | | |
| 6 | NTIS (US Sales Only), PC A05/MF A01 | | DE85752508 | MN -13 | 10:46613 |
| 7 | NTIS (US Sales Only), PC A05/MF A01; 1 | | DE85752509 | MN -38 | 10:46982 |
| 8 | NTIS (US Sales Only), PC A09/MF A01 | | DE85752531 | MN -58 | 10:46271 |
| 9 | NTIS (US Sales Only), PC A06/MF A01; 1 | | DE85752510 | MN -13 | 10:46614 |
| **EFN-AES-** | | | | | |
| 1984-2 | NTIS (US Sales Only), PC A04/MF A01; 1 | | DE85752555 | MN -90f | 10:46628 |
| **EGG-** | | | | | |
| 2386 | NTIS, PC A05/MF A01 (GPO Dep.) | E 1.99: | DE85016025 | STD -70 | 10:46211 |
| 10282-1087 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: | DE85016787 | MN -38 | 10:46917 |
| 10282-2062 | NTIS, PC A02/MF A01; 1 (GPO Dep.) | E 1.99: | DE85016567 | MN -37 | 10:47138 |
| **EGG/CDAP-TR-** | | | | | |
| 78-034 | NTIS, PC A04 - GPO | | DE85016688 | MN -78 | 10:46505 |
| **EGG-EA-** | | | | | |
| 6948 | NTIS, PC A05/MF A01 - GPO | | TI85017499 | MN -78 | 10:46506 |
| **EGG/LTR-** | | | | | |
| 17-55 | NTIS, PC A02; 3 | | DE85015852 | MN -78 | 10:46490 |
| 20-80 | NTIS, PC A04; 3 | | DE85015872 | MN -78 | 10:46507 |
| 1113-2 | NTIS, PC A03/MF A01 - GPO | | TI85016691 | MN -78 | 10:46508 |
| **EGG-M-** | | | | | |
| 03985 | NTIS MF A01; 2 | | TI85008003 | MN -78 | 10:46509 |
| 09985 | NTIS, PC A02; 3 | | DE85017474 | MN -11 | 10:47448 |
| 11685 | NTIS, PC A02/MF A01; 1 (GPO Dep.) | E 1.99: | DE85014582 | MN -37 | 10:46911 |
| **EGG-MS-** | | | | | |
| 6843 | NTIS, PC A04/MF A01 (GPO Dep.) | E 1.99: | DE85017472 | MN -79r | 10:46459 |
| 6872 | NTIS, PC A03/MF A01; 1 (GPO Dep.) | E 1.99: | DE85017494 | MN -38 | 10:46955 |
| **EGG-PBS-** | | | | | |
| 6887 | NTIS, PC A03/MF A01 - GPO | | TI85017485 | MN -78 | 10:46483 |
| 6928 | NTIS, PC A03/MF A01 - GPO | | TI85017470 | MN -78 | 10:46484 |
| 6931 | NTIS, PC A04 - GPO | | DE85017461 | MN -78 | 10:46485 |
| 6935 | NTIS, PC A04/MF A01 - GPO | | TI85017460 | MN -78 | 10:46486 |
| 6966 | NTIS, PC A04/MF A01 - GPO | | TI85017496 | MN -78 | 10:46487 |
| **EGG-RE-E-** | | | | | |
| 77-140 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: | DE85013341 | MN -78 | 10:46510 |
| **EGG-RST-** | | | | | |
| 6911 | NTIS, PC A03/MF A01 - GPO | | TI85017467 | MN -80 | 10:46446 |
| 6984 | NTIS, PC A04/MF A01 - GPO | | TI85017468 | MN -80 | 10:46511 |
| **EGG-SEMI-** | | | | | |
| 6919 | NTIS, PC A03/MF A01 - GPO | | TI85017486 | MN -78 | 10:46512 |
| 6985 | NTIS, PC A03/MF A01 - GPO | | TI85017495 | MN -80 | 10:46513 |
| **EGG-TMI-** | | | | | |
| 6894 | NTIS, PC A04/MF A01; 1 (GPO Dep.) | E 1.99: | DE85017500 | MN -78 | 10:46514 |
| **EGG-WM-F-** | | | | | |
| 1-81-024 | NTIS, PC A07/MF A01; 1 (GPO Dep.) | E 1.99: | DE85017234 | MN -70 | 10:46182 |
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| 4002 | Research Reports Center, Box 50490, Palo Alto, CA, 94303 | | TI85920858 | ND -97a | 10:46392 |
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| 83010 | NTIS (US Sales Only), PC A03/MF A01 | | DE85702069 | MN -20 | 10:47935 |
| 83011 | NTIS (US Sales Only), PC A03/MF A01 | | DE85702114 | MN -4 | 10:47936 |
| 83018 | NTIS (US Sales Only), PC A03/MF A01 | | DE85702075 | MN -20 | 10:47937 |
| 84022 | NTIS (US Sales Only), PC A04/MF A01 | | DE85702078 | MN -20 | 10:47938 |
| 84025 | NTIS (US Sales Only), PC A03/MF A01 | | DE85702070 | MN -20 | 10:47939 |
| 84026 | NTIS (US Sales Only), PC A03/MF A01 | | DE85702079 | MN -20 | 10:47940 |
| 84027 | NTIS (US Sales Only), PC A04/MF A01 | | DE85702080 | MN -20 | 10:47941 |
| 84029 | NTIS (US Sales Only), PC A09/MF A01 | | DE85702074 | MN -20 | 10:47942 |
| 84032 | NTIS (US Sales Only), PC A04/MF A01 | | DE85702073 | MN -20 | 10:47943 |
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| 2306-54-Draft | *See* DOE/ET/10592-T3 | E 1.99: | DE85017625 | MN -90d | 10:45965 |
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| 1405 | NTIS (US Sales Only), PC A02/MF A01 | | DE85702153 | MN -23 | 10:47078 |
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| 85/ 94 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: | DE85015817 | MN -34D | 10:47535 |
| 85-100-A | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: | DE85013220 | MN -34B | 10:47472 |
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| 1296 | NTIS, PC A03/MF A01 (GPO Dep.) | E 1.99: | DE85017366 | STD -41 | 10:47865 |
| 1314 | NTIS, PC A02/MF A01; 1 (GPO Dep.) | E 1.99: | DE85017439 | STD -28 | 10:47025 |
| 1324 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: | DE85017438 | STD -28 | 10:47010 |
| 1325 | NTIS, PC A02/MF A01; 1 (GPO Dep.) | E 1.99: | DE85017444 | STD -28 | 10:47026 |
| 1326 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: | DE85017441 | STD -28 | 10:47011 |
| 1327 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: | DE85017440 | STD -28 | 10:47027 |
| 1328 | NTIS, PC A02/MF A01; 1 (GPO Dep.) | E 1.99: | DE85017442 | MN -28 | 10:47012 |
| 1329 | NTIS, PC A02/MF A01; 1 (GPO Dep.) | E 1.99: | DE85017445 | STD -28 | 10:46995 |
| 1330 | NTIS, PC A02/MF A01; 1 (GPO Dep.) | E 1.99: | DE85017443 | STD -28 | 10:46996 |
| 1334 | NTIS, PC A02; 3 | | DE85016987 | STD -38 | 10:46918 |
| 1338 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: | DE85017365 | STD -28 | 10:47013 |
| 1339 | NTIS, PC A02; 3 | | DE85017364 | STD -28 | 10:47014 |
| 1340 | NTIS, PC A02; 3 | | DE85017363 | STD -28 | 10:47015 |
| 1341 | NTIS, PC A02/MF A01; 1 (GPO Dep.) | E 1.99: | DE85017362 | STD -28 | 10:47028 |
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| 1629 | NTIS (US Sales Only), PC A07/MF A01 | DE85752175 | MN -34B | 10:47079 |
| 1635 | NTIS (US Sales Only), PC A09/MF A01 | DE85752174 | MN -34B | 10:47494 |
| 1636 | NTIS (US Sales Only), PC A06/MF A01 | DE85752176 | MN -34B | 10:47473 |
| 1926 | NTIS (US Sales Only), PC A10/MF A01 | DE85752177 | MN -28 | 10:46997 |
| 2005 | NTIS (US Sales Only), PC A12/MF A01 | DE85752142 | MN -34A | 10:47505 |
| 2007 | NTIS (US Sales Only), PC A06/MF A01 | DE85752180 | MN -25 | 10:46801 |
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| 82/ 58-2 | NTIS, PC A11/MF A01 | TI85901999 | MN -11 | 10:47271 |
| **GEAP-** | | | | |
| 25272 | *See* NUREG/CR-1558 | TI85920182 | ND -78 | 10:46545 |
| **GKSS-** | | | | |
| 85/ E/ 8 | NTIS (US Sales Only) | DE85752246 | MN -80 | 10:46491 |
| 85/ E/ 11 | NTIS (US Sales Only) | DE85752247 | MN -34C | 10:46834 |
| **GRS-F-** | | | | |
| 143 | NTIS (US Sales Only), PC A04/MF A01 | DE85752338 | MN -80 | 10:46515 |
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| 85-10 | NTIS (US Sales Only) | DE85752251 | MN -34C | 10:47792 |
| 85-17(prepr.) | NTIS (US Sales Only) | DE85752252 | MN -34C | 10:47784 |
| 85-18-Prepr. | NTIS (US Sales Only), PC A04/MF A01 | DE85752336 | MN -34C | 10:47710 |
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| 3909/ 10 | NTIS (US Sales Only), PC A02/MF A01 | DE85702118 | MN -25 | 10:46730 |
| **IAEA-SR-** | | | | |
| 83-5 | *See* SSI-A-84-16 | DE85702148 | MN -41 | 10:47871 |
| **IAEA-TECDOC-** | | | | |
| 325 | NTIS (US Sales Only), PC A08/MF A01 | DE85781628 | MN -48 | 10:47332 |
| 328 | NTIS (US Sales Only), PC A18/MF A01 | DE85781627 | MN -51 | 10:46101 |
| 330 | NTIS (US Sales Only), PC A11/MF A01 | DE85781626 | MN -48 | 10:46835 |
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| 83 | *See* STEV-1984-1 | DE85752530 | MN -61A | 10:46332 |
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| C5 | NTIS (US Sales Only) | TI85902112 | ND -98A | 10:46051 |
| **IFVE-OEF-** | | | | |
| 84-108 | NTIS (US Sales Only), PC A02/MF A01 | DE85702215 | MN -37 | 10:47080 |
| **IFVE-OEIPK-** | | | | |
| 84-73 | NTIS (US Sales Only), PC A03/MF A01 | DE85702096 | MN -34D | 10:47554 |
| **IFVE-OI-** | | | | |
| 84-16 | NTIS (US Sales Only), PC A02/MF A01 | DE85702155 | MN -28 | 10:47016 |
| **IFVE-ONF-** | | | | |
| 84-51 | NTIS (US Sales Only), PC A02/MF A01 | DE85702216 | MN -37 | 10:47081 |
| 84-80 | NTIS (US Sales Only), PC A02/MF A01 | DE85702217 | MN -37 | 10:47082 |
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| 84-19 | NTIS (US Sales Only), PC A02/MF A01 | DE85702085 | MN -34D | 10:47584 |
| 84-58 | NTIS (US Sales Only), PC A02/MF A01 | DE85702086 | MN -34D | 10:47585 |
| 84-61 | NTIS (US Sales Only), PC A02/MF A01 | DE85702087 | MN -34D | 10:47586 |
| 84-137 | NTIS (US Sales Only), PC A02/MF A01 | DE85702043 | MN -34D | 10:47883 |
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| 84-13 | NTIS, PC A10/MF A01 | TI85902108 | ND -88 | 10:46033 |
| 84-19 | NTIS (US Sales Only), PC A04/MF A01 | TI85902107 | ND -90 | 10:46252 |
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| 0092 | NTIS (US Sales Only), PC A04/MF A01 | DE85702224 | MN -70 | 10:47458 |
| 0097 | NTIS (US Sales Only), PC A04/MF A01 | DE85702145 | MN -41 | 10:47866 |
| 0097-App.A | NTIS (US Sales Only), PC A07/MF A01 | DE85702146 | MN -41 | 10:47867 |
| 0097-App.B | NTIS (US Sales Only), PC A13/MF A01 | DE85702147 | MN -41 | 10:47868 |
| 0108 | NTIS (US Sales Only), PC A03/MF A01 | DE85702226 | MN -2 | 10:47997 |
| 0118 | NTIS (US Sales Only), PC A09/MF A01 | DE85702119 | MN -25 | 10:46731 |
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| 9343 | NTIS (US Sales Only), PC A04/MF A01 | DE85781609 | MN -48 | 10:47313 |
| 9344 | NTIS (US Sales Only), PC A06/MF A01 | DE85781608 | MN -48 | 10:47314 |
| 9347 | NTIS (US Sales Only), PC A09/MF A01 | DE85781596 | MN -34C | 10:47665 |
| 9348 | NTIS (US Sales Only), PC A06/MF A01 | DE85781597 | MN -34C | 10:47675 |
| 9349 | NTIS (US Sales Only), PC A12/MF A01 | DE85781591 | MN -34D | 10:47587 |
| 9350 | NTIS (US Sales Only), PC A04/MF A01 | DE85781589 | MN -34D | 10:47885 |
| 9351 | NTIS (US Sales Only), PC A99/MF A01 | DE85781594 | MN -34C | 10:47655 |
| 9356 | NTIS (US Sales Only), PC A10/MF A01 | DE85781611 | MN -25 | 10:46460 |
| 9357 | NTIS (US Sales Only), PC A03/MF A01 | DE85781614 | MN -70 | 10:47288 |
| 9358 | NTIS (US Sales Only), PC A06/MF A01 | DE85781603 | MN -51 | 10:47449 |
| 9359 | NTIS (US Sales Only), PC A07/MF A01 | DE85781604 | MN -51 | 10:47450 |
| 9676 | NTIS (US Sales Only), PC A05/MF A01 | DE85781613 | MN -37 | 10:47088 |
| 9677 | NTIS (US Sales Only), PC A05/MF A01 | DE85781593 | MN -46 | 10:46447 |
| 9678 | NTIS (US Sales Only), PC A07/MF A01 | DE85781615 | MN -2 | 10:46406 |
| 9679 | NTIS (US Sales Only), PC A06/MF A01 | DE85781602 | MN -51 | 10:46102 |
| 9687 | NTIS (US Sales Only), PC A03/MF A01 | DE85702124 | MN -51 | 10:46151 |
| 9688 | NTIS (US Sales Only), PC A02/MF A01 | DE85702125 | MN -51 | 10:46152 |
| 9743 | NTIS (US Sales Only), PC A04/MF A01 | DE85781606 | MN -23 | 10:47372 |
| 9758 | NTIS (US Sales Only), PC A08/MF A01 | DE85781601 | MN -51 | 10:47390 |

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| 9761 | NTIS (US Sales Only), PC A04/MF A01 | DE85781605 | MN -11 | 10:47440 |
| 9762 | NTIS (US Sales Only), PC A04/MF A01 | DE85781612 | MN -80 | 10:46523 |
| 9766 | NTIS (US Sales Only), PC A02/MF A 01 | DE86780005 | MN -34A | 10:46807 |
| 9902 | NTIS (US Sales Only), PC A05/MF A01 | DE86780004 | MN -34A | 10:47901 |
| **INIS-SU-** | | | | |
| 299 | NTIS (US Sales Only), PC A17/MF A01 | DE85781599 | MN -4 | 10:47445 |
| 300 | NTIS (US Sales Only), PC A08/MF A01 | DE85781600 | MN -4 | 10:46862 |
| 301 | NTIS (US Sales Only), PC A18/MF A01 | DE85781590 | MN -20 | 10:47858 |
| 302 | NTIS (US Sales Only), PC A19/MF A01 | DE85781610 | MN -28 | 10:47001 |
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| 483 | NTIS (US Sales Only), PC A02/MF A01 | DE85702104 | MN -34C | 10:47836 |
| 485 | NTIS (US Sales Only), PC A02/MF A01 | DE85702095 | MN -34D | 10:47594 |
| 486 | NTIS (US Sales Only), PC A02/MF A01 | DE85702088 | MN -34D | 10:47595 |
| 488 | NTIS (US Sales Only), PC A04/MF A01 | DE85702107 | MN -34C | 10:47683 |
| 489 | NTIS (US Sales Only), PC A02/MF A01 | DE85702046 | MN -34D | 10:47631 |
| 491 | NTIS (US Sales Only), PC A02/MF A01 | DE85702089 | MN -34D | 10:47596 |
| 494 | NTIS (US Sales Only), PC A02/MF A01 | DE85702108 | MN -34C | 10:47684 |
| **INS-NUMA-** | | | | |
| 55 | NTIS (US Sales Only), PC A02/MF A01 | DE85702076 | MN -20 | 10:47945 |
| **IPNO-DRE-** | | | | |
| 84-32 | NTIS (US Sales Only), PC A02/MF A01 | DE85752039 | MN -34C | 10:47791 |
| **IPNO-TH-** | | | | |
| 84-08 | NTIS (US Sales Only), PC A02/MF A01 | DE85752144 | MN -34D | 10:47597 |
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| 659 | NTIS (US Sales Only), PC A02/MF A01 | DE85702057 | MN -20 | 10:47946 |
| 660 | NTIS (US Sales Only), PC A21/MF A01 | DE85702071 | MN -20 | 10:47947 |
| 661 | NTIS (US Sales Only), PC A03/MF A01 | DE85702062 | MN -20 | 10:47902 |
| 662 | NTIS (US Sales Only), PC A02/MF A01 | DE85702058 | MN -20 | 10:47903 |
| 664 | NTIS (US Sales Only), PC A02/MF A01 | DE85702063 | MN -20 | 10:47904 |
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| 673 | NTIS (US Sales Only), PC A02/MF A01 | DE85702065 | MN -20 | 10:47908 |
| **IPPJ-DT-** | | | | |
| 114 | NTIS (US Sales Only), PC A03/MF A01 | DE85702060 | MN -20 | 10:47909 |
| **IS-M-** | | | | |
| 542 | NTIS, PC A02/MF A01; 1 (GPO Dep.) | E 1.99: DE85015511 | MN -80 | 10:46524 |
| 549 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: DE85015523 | MN -34A | 10:47512 |
| 560 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: DE85017344 | MN -90a | 10:45973 |
| 561 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: DE85017346 | MN -25 | 10:46714 |
| **IS-T-** | | | | |
| 1181 | NTIS, PC A08/MF A01 (GPO Dep.) | E 1.99: DE85017347 | MN -38 | 10:47876 |
| 1192 | NTIS, PC A06/MF A01 (GPO Dep.) | E 1.99: DE85017170 | MN -38 | 10:47877 |
| **ISPO-** | | | | |
| 234 | *See* LA-10430-M | E 1.99: DE85017954 | STD -15 | 10:46227 |
| 240 | *See* LA-10433-M | E 1.99: DE85017955 | STD -15 | 10:46228 |
| **ITEF-** | | | | |
| 53(1984) | NTIS (US Sales Only), PC A03/MF A01 | DE85702218 | MN -37 | 10:47095 |
| 153(1983) | NTIS (US Sales Only), PC A02/MF A01 | DE85702090 | MN -34D | 10:47598 |
| **ITF-** | | | | |
| 83-72-R | NTIS (US Sales Only), PC A02/MF A01 | DE85702105 | MN -34C | 10:47837 |
| 84-43-R | NTIS (US Sales Only), PC A02/MF A01 | DE85702091 | MN -34D | 10:47599 |
| **IVA-** | | | | |
| 274 | NTIS (US Sales Only), PC A04/MF A01 | DE85752519 | MN -94cc | 10:46882 |
| 275 | NTIS (US Sales Only), PC A07/MF A01; 1 | DE85752543 | MN -61D | 10:46661 |
| **IVL-B-** | | | | |
| 752 | NTIS (US Sales Only), PC A02/MF A01; 1 | DE85752539 | MN -11 | 10:47280 |
| **JAERI-M-** | | | | |
| 83-176 | NTIS (US Sales Only), PC A07/MF A01 | DE85702169 | MN -80 | 10:46423 |
| 83-202 | NTIS (US Sales Only), PC A03/MF A01 | DE85702170 | MN -80 | 10:46451 |
| 84-022 | NTIS (US Sales Only), PC A03/MF A01 | DE85702227 | MN -32 | 10:47859 |
| 84-026 | NTIS (US Sales Only), PC A05/MF A01 | DE85702194 | MN -78 | 10:46525 |
| 84-027 | NTIS (US Sales Only), PC A03/MF A01 | DE85702228 | MN -32 | 10:47975 |
| 84-029 | NTIS (US Sales Only), PC A04/MF A01 | DE85702187 | MN -78 | 10:46526 |
| 84-030 | NTIS (US Sales Only), PC A08/MF A01 | DE85702188 | MN -78 | 10:46527 |
| 84-039 | NTIS (US Sales Only), PC A05/MF A01 | DE85702229 | MN -32 | 10:47976 |
| 84-042 | NTIS (US Sales Only), PC A05/MF A01 | DE85702195 | MN -78 | 10:46528 |
| 84-045 | NTIS (US Sales Only), PC A11/MF A01 | DE85702189 | MN -78 | 10:46529 |
| 84-046 | NTIS (US Sales Only), PC A09/MF A01 | DE85702190 | MN -78 | 10:46493 |
| 84-055 | NTIS (US Sales Only), PC A21/MF A01 | DE85702191 | MN -78 | 10:46530 |
| 84-056 | NTIS (US Sales Only), PC A04/MF A01 | DE85702181 | MN -80 | 10:46475 |
| 84-057 | NTIS (US Sales Only), PC A05/MF A01 | DE85702158 | MN -28 | 10:47034 |
| 84-061 | NTIS (US Sales Only), PC A11/MF A01 | DE85702230 | MN -32 | 10:47977 |
| 84-063 | NTIS (US Sales Only), PC A09/MF A01 | DE85702196 | MN -78 | 10:46531 |
| 84-064 | NTIS (US Sales Only), PC A09/MF A01 | DE85702231 | MN -32 | 10:47978 |
| 84-065 | NTIS (US Sales Only), PC A08/MF A01 | DE85702197 | MN -78 | 10:46532 |
| 84-066 | NTIS (US Sales Only), PC A05/MF A01 | DE85702206 | MN -80 | 10:46494 |
| 84-071 | NTIS (US Sales Only), PC A03/MF A01 | DE85702055 | MN -34A | 10:46736 |
| 84-072 | NTIS (US Sales Only), PC A06/MF A01 | DE85702232 | MN -32 | 10:47948 |
| 84-076 | NTIS (US Sales Only), PC A04/MF A01 | DE85702171 | MN -80 | 10:46432 |
| 84-079 | NTIS (US Sales Only), PC A07/MF A01 | DE85702172 | MN -80 | 10:46495 |
| 84-081 | NTIS (US Sales Only), PC A04/MF A01 | DE85702192 | MN -78 | 10:46407 |
| 84-083 | NTIS (US Sales Only), PC A03/MF A01 | DE85702200 | MN -77 | 10:46424 |

| Report Number | Availability Source | File Number | Distribution Category | Abstract Number |
|---|---|---|---|---|
| 84-084 | NTIS (US Sales Only), PC A03/MF A01 | DE85702182 | MN -80 | 10:46476 |
| 84-086 | NTIS (US Sales Only), PC A03/MF A01 | DE85702173 | MN -80 | 10:46496 |
| 84-088 | NTIS (US Sales Only), PC A03/MF A01 | DE85702201 | MN -77 | 10:46425 |
| 84-091 | NTIS (US Sales Only), PC A02/MF A01 | DE85702056 | MN -34A | 10:46808 |
| 84-099 | NTIS (US Sales Only), PC A07/MF A01 | DE85702174 | MN -80 | 10:46497 |
| 84-110 | NTIS (US Sales Only), PC A04/MF A01 | DE85702175 | MN -80 | 10:46453 |
| 84-122 | NTIS (US Sales Only), PC A07/MF A01 | DE85702178 | MN -80 | 10:46461 |
| 84-127 | NTIS (US Sales Only), PC A04/MF A01 | DE85702176 | MN -80 | 10:46454 |
| 84-128 | NTIS (US Sales Only), PC A02/MF A01 | DE85702202 | MN -77 | 10:46426 |
| 84-130 | NTIS (US Sales Only), PC A03/MF A01 | DE85702203 | MN -77 | 10:46427 |
| 84-131 | NTIS (US Sales Only), PC A11/MF A01 | DE85702198 | MN -78 | 10:46533 |
| 84-132 | NTIS (US Sales Only), PC A06/MF A01 | DE85702199 | MN -78 | 10:46534 |
| 84-135 | NTIS (US Sales Only), PC A10/MF A01 | DE85702193 | MN -78 | 10:46535 |
| 84-143 | NTIS (US Sales Only), PC A02/MF A01 | DE85702233 | MN -32 | 10:46863 |
| **JINR-** | | | | |
| 1-84-455 | NTIS (US Sales Only), PC A02/MF A01 | DE85702112 | MN -34C | 10:47770 |
| 1-84-457 | NTIS (US Sales Only), PC A02/MF A01 | DE85702097 | MN -34D | 10:47559 |
| 3-84-484 | NTIS (US Sales Only), PC A02/MF A01 | DE85702110 | MN -34C | 10:47719 |
| 9-84-432 | NTIS (US Sales Only), PC A02/MF A01 | DE85702209 | MN -37 | 10:47096 |
| 9-84-522 | NTIS (US Sales Only), PC A02/MF A01 | DE85702156 | MN -28 | 10:47019 |
| 10-84-87 | NTIS (US Sales Only), PC A02/MF A01 | DE85702211 | MN -37 | 10:47097 |
| 10-84-420 | NTIS (US Sales Only), PC A02/MF A01 | DE85702234 | MN -32 | 10:47979 |
| 10-84-613 | NTIS (US Sales Only), PC A02/MF A01 | DE85702235 | MN -32 | 10:47980 |
| 13-84-386 | NTIS (US Sales Only), PC A02/MF A01 | DE85702212 | MN -37 | 10:47098 |
| 13-84-387 | NTIS (US Sales Only), PC A02/MF A01 | DE85702213 | MN -37 | 10:47099 |
| 13-84-579 | NTIS (US Sales Only), PC A02/MF A01 | DE85702214 | MN -37 | 10:47100 |
| 13-84-583 | NTIS (US Sales Only), PC A02/MF A01 | DE85702220 | MN -37 | 10:47101 |
| 14-84-536 | NTIS (US Sales Only), PC A02/MF A01 | DE85702115 | MN -4 | 10:46864 |
| 16-84-635 | NTIS (US Sales Only), PC A02/MF A01 | DE85702208 | MN -37 | 10:47102 |
| 18-84-392 | NTIS (US Sales Only), PC A02/MF A01 | DE85702113 | MN -4 | 10:46850 |
| E-1-84-376 | NTIS (US Sales Only), PC A02/MF A01 | DE85702109 | MN -34C | 10:47687 |
| E-1-84-515 | NTIS (US Sales Only), PC A02/MF A01 | DE85702219 | MN -37 | 10:47560 |
| E-1-84-560 | NTIS (US Sales Only), PC A02/MF A01 | DE85702053 | MN -34A | 10:47513 |
| E-2-84-173 | NTIS (US Sales Only), PC A02/MF A01 | DE85702103 | MN -34C | 10:47838 |
| E-2-84-410 | NTIS (US Sales Only), PC A02/MF A01 | DE85702047 | MN -34D | 10:47632 |
| E-2-84-465 | NTIS (US Sales Only), PC A02/MF A01 | DE85702051 | MN -34D | 10:47633 |
| R-2-84-111 | NTIS (US Sales Only), PC A02/MF A01 | DE85702045 | MN -34D | 10:47886 |
| R-2-84-302 | NTIS (US Sales Only), PC A02/MF A01 | DE85702048 | MN -34D | 10:47634 |
| R-2-84-530 | NTIS (US Sales Only), PC A02/MF A01 | DE85702049 | MN -34D | 10:47635 |
| R-2-84-540 | NTIS (US Sales Only), PC A02/MF A01 | DE85702081 | MN -34B | 10:47474 |
| R-2-84-646 | NTIS (US Sales Only), PC A02/MF A01 | DE85702092 | MN -34D | 10:47600 |
| R-4-84-427 | NTIS (US Sales Only), PC A02/MF A01 | DE85702093 | MN -34D | 10:47601 |
| R-8-84-547 | NTIS (US Sales Only), PC A02/MF A01 | DE85702083 | MN -34A | 10:47878 |
| R-9-84-445 | NTIS (US Sales Only), PC A02/MF A01 | DE85702159 | MN -28 | 10:47036 |
| R-17-84-107 | NTIS (US Sales Only), PC A02/MF A01 | DE85702082 | MN -34A | 10:47879 |
| R-19-84-655 | NTIS (US Sales Only), PC A02/MF A01 | DE85702140 | MN -48 | 10:47391 |
| **JINR-R-** | | | | |
| 4-84-638 | NTIS (US Sales Only), PC A02/MF A01 | DE85702101 | MN -34C | 10:47839 |
| 6-84-556 | NTIS (US Sales Only), PC A02/MF A01 | DE85702111 | MN -34C | 10:47771 |
| 19-84-647 | NTIS (US Sales Only), PC A02/MF A01 | DE85702139 | MN -48 | 10:47392 |
| **JPL/D-** | | | | |
| 1653 | *See* DOE/MC/20417-1745 | E 1.99: DE85007314 | STD -90c | 10:45943 |
| 1750 | *See* DOE/MC/20417-1747 | E 1.99: DE85007311 | STD -90c | 10:45944 |
| **JPL-PUB-** | | | | |
| 85-27 | *See* DOE/JPL-1012-104 | E 1.99: DE85017592 | STD -63b | 10:46312 |
| 85-54 | *See* DOE/JPL-1060-88 | E 1.99: DE85017590 | STD -62 | 10:46272 |
| **Juel-** | | | | |
| 1966 | NTIS (US Sales Only) | DE85752235 | MN -25 | 10:46737 |
| 1969 | NTIS (US Sales Only) | DE85752250 | MN -70 | 10:46184 |
| 1976 | NTIS (US Sales Only), PC A07/MF A01 | DE85752332 | MN -80 | 10:46428 |
| 1979 | NTIS (US Sales Only), PC A04/MF A01 | DE85752331 | MN -80 | 10:46462 |
| **Juel-Spez-** | | | | |
| 269 | NTIS (US Sales Only), PC A07/MF A01 | DE85752326 | MN -16 | 10:46226 |
| 281 | NTIS (US Sales Only) | DE85752240 | MN -83 | 10:46185 |
| 283 | NTIS (US Sales Only) | DE85752236 | MN -34C | 10:47840 |
| 299 | NTIS (US Sales Only) | DE85752244 | MN -80 | 10:46429 |
| 300 | NTIS (US Sales Only), PC A03/MF A01 | DE85752320 | MN -28 | 10:47037 |
| **K-** | | | | |
| 2056 | NTIS, PC A03/MF A01 (GPO Dep.) | E 1.99: DE85017073 | STD -71 | 10:46921 |
| **K/CSD/INF-** | | | | |
| 85/ 8 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: DE85016304 | MN -32 | 10:47964 |
| **K/D-** | | | | |
| 5645 | NTIS, PC A05/MF A01 (GPO Dep.) | E 1.99: DE85017244 | MN -38 | 10:46922 |
| **KAERC-** | | | | |
| 1/ 84 | NTIS (US Sales Only), PC A02/MF A01 | DE85702236 | MN -32 | 10:47982 |
| 2/ 84 | NTIS (US Sales Only), PC A02/MF A01 | DE85702207 | MN -80 | 10:46498 |
| 3/ 84 | NTIS (US Sales Only), PC A02/MF A01 | DE85702183 | MN -80 | 10:46477 |
| 4/ 84 | NTIS (US Sales Only), PC A02/MF A01 | DE85702102 | MN -34C | 10:47841 |
| 6/ 84 | NTIS (US Sales Only), PC A02/MF A01 | DE85702177 | MN -80 | 10:46455 |
| 8/ 84 | NTIS (US Sales Only), PC A02/MF A01 | DE85702098 | MN -46 | 10:47860 |
| **KC-** | | | | |
| 84/ 02d | NTIS (US Sales Only), PC A03/MF A01 | DE85752631 | MN -38 | 10:46983 |
| **KEK-** | | | | |
| 83-7 | NTIS (US Sales Only), PC A03/MF A01 | DE85702163 | MN -28 | 10:47051 |

| Report Number | Availability Source | File Number | | Distribution Category | Abstract Number |
|---|---|---|---|---|---|
| 83-8 | NTIS (US Sales Only), PC A02/MF A01 | | DE85702164 | MN -28 | 10:47052 |
| 83-9 | NTIS (US Sales Only), PC A02/MF A01 | | DE85702165 | MN -28 | 10:47053 |
| 83-10 | NTIS (US Sales Only), PC A02/MF A01 | | DE85702160 | MN -28 | 10:47038 |
| 83-17 | NTIS (US Sales Only), PC A03/MF A01 | | DE85702162 | MN -28 | 10:47054 |
| **KFK-** | | | | | |
| 3709 | NTIS (US Sales Only) | | DE85752241 | MN -79p | 10:46536 |
| 3822 | NTIS (US Sales Only) | | DE85752242 | MN -80 | 10:46401 |
| 3835 | NTIS (US Sales Only) | | DE85752245 | MN -86 | 10:46238 |
| 3904 | NTIS (US Sales Only) | | DE85752243 | MN -78 | 10:46415 |
| 3907 | NTIS (US Sales Only), PC A05/MF A01 | | DE85752328 | MN -78 | 10:46537 |
| 3911 | NTIS (US Sales Only), PC A05/MF A01 | | DE85752330 | MN -32 | 10:47983 |
| 3914 | NTIS (US Sales Only), PC A03/MF A01 | | DE85752327 | MN -34C | 10:47861 |
| 3921 | NTIS (US Sales Only), PC A04/MF A01 | | DE85752329 | MN -78 | 10:46538 |
| 3928 | NTIS (US Sales Only), PC A05/MF A01 | | DE85752335 | MN -11 | 10:47200 |
| 3929 | NTIS (US Sales Only), PC A05/MF A01 | | DE85752337 | MN -11 | 10:47201 |
| **KFKI-** | | | | | |
| 1984-94 | NTIS (US Sales Only), PC A04/MF A01; 1 | | DE85902006 | MN -25 | 10:46738 |
| **KGI-PREPR-** | | | | | |
| 065 | NTIS (US Sales Only), PC A03/MF A01 | | DE85702137 | MN -34B | 10:47495 |
| 068 | NTIS (US Sales Only), PC A02/MF A01 | | DE85702138 | MN -34B | 10:47496 |
| **KI-** | | | | | |
| 1983-7 | NTIS (US Sales Only), PC A02/MF A01 | | DE85752556 | MN -25 | 10:46089 |
| 1983-8 | NTIS (US Sales Only), PC A03/MF A01; 1 | | DE85752557 | MN -92 | 10:46072 |
| **KIYI-** | | | | | |
| 83-21 | NTIS (US Sales Only), PC A02/MF A01 | | DE85702157 | MN -28 | 10:47039 |
| **KMU-HEP-** | | | | | |
| 84-08 | NTIS (US Sales Only), PC A06/MF A01 | | DE85781587 | MN -34D | 10:47536 |
| **KVL-JI-MEDD-** | | | | | |
| 47 | NTIS (US Sales Only), PC A04/MF A01; 1 | | DE85752665 | MN -95e | 10:46696 |
| **LA-** | | | | | |
| 8050-NERP-Vol.3 | NTIS, PC A07/MF A01 (GPO Dep.) | E 1.99: | DE85017704 | STD -11 | 10:47260 |
| 8361-MS | *See* NUREG/CR-1480 | | TI85015912 | MN -78 | 10:46544 |
| 10055-MS | *See* NUREG/CR-3706 | | TI85014233 | MN -78 | 10:46550 |
| 10375-PR | NTIS, PC A04/MF A01 (GPO Dep.) | E 1.99: | DE85017958 | STD -80 | 10:47862 |
| 10400-MS-Vol.1 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: | DE85017945 | STD -32 | 10:47984 |
| 10400-MS-Vol.2 | NTIS, PC A03/MF A01 (GPO Dep.) | E 1.99: | DE85017946 | STD -32 | 10:47985 |
| 10430-M | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: | DE85017954 | STD -15 | 10:46227 |
| 10433-M | NTIS, PC A03/MF A01; 1 (GPO Dep.) | E 1.99: | DE85017955 | STD -15 | 10:46228 |
| 10461-MS | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: | DE85017947 | STD -10 | 10:46896 |
| 10474-MS | *See* NUREG/CR-4314 | | TI85016129 | MN -80 | 10:46555 |
| 10492-MS | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: | DE85017948 | STD -32 | 10:47986 |
| 10497-T | NTIS, PC A09/MF A01; 1 (GPO Dep.) | E 1.99: | DE85017952 | STD -13 | 10:47965 |
| 10503 | NTIS, PC A03/MF A01 (GPO Dep.) | E 1.99: | DE85017950 | MN -13 | 10:47966 |
| **LA-UR-** | | | | | |
| 85-1391-Rev. | NTIS, PC A02; 3 | | DE85015691 | MN -32 | 10:47987 |
| 85-2212 | NTIS, PC A02/MF A01; 1 (GPO Dep.) | E 1.99: | DE85014086 | MN -94cc | 10:46793 |
| 85-2281 | NTIS, PC A03/MF A01 (GPO Dep.) | E 1.99: | DE85014069 | MN -34D | 10:47842 |
| 85-2332 | NTIS, PC A02/MF A01; 1 (GPO Dep.) | E 1.99: | DE85015681 | MN -4 | 10:46907 |
| 85-2346 | NTIS, PC A03/MF A01; 1 (GPO Dep.) | E 1.99: | DE85015678 | MN -34D | 10:47561 |
| 85-2349 | NTIS, PC A02/MF A01; 1 (GPO Dep.) | E 1.99: | DE85015679 | MN -37 | 10:46963 |
| 85-2352 | NTIS, PC A03/MF A01; 1 (GPO Dep.) | E 1.99: | DE85015676 | MN -28 | 10:47003 |
| 85-2443 | NTIS, PC A02/MF A01; 1 (GPO Dep.) | E 1.99: | DE85015716 | MN -33 | 10:47537 |
| 85-2510 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: | DE85015701 | MN -37 | 10:47159 |
| 85-2553 | NTIS, PC A03/MF A01 (GPO Dep.) | E 1.99: | DE85015695 | MN -48 | 10:47426 |
| 85-2701 | NTIS, PC A02; 3 (GPO Dep.) | E 1.99: | DE85015737 | MN -34C | 10:47843 |
| 85-2704 | NTIS, PC A03/MF A01 (GPO Dep.) | E 1.99: | DE85015735 | MN -34C | 10:47844 |
| 85-2805 | NTIS, PC A02/MF A01; 1 (GPO Dep.) | E 1.99: | DE85017568 | MN -70 | 10:46739 |
| 85-2821 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: | DE85017567 | MN -25 | 10:46740 |
| 85-2833 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: | DE85017566 | MN -4 | 10:46865 |
| 85-2840 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: | DE85017564 | MN -38 | 10:46964 |
| 85-2844 | NTIS, PC A02/MF A01; 1 (GPO Dep.) | E 1.99: | DE85017563 | MN -59B | 10:46367 |
| 85-2845 | NTIS, PC A02/MF A01; 1 (GPO Dep.) | E 1.99: | DE85017562 | MN -59B | 10:46368 |
| 85-2861 | NTIS, PC A02/MF A01; 1 (GPO Dep.) | E 1.99: | DE85017560 | MN -25 | 10:46741 |
| 85-2879 | NTIS, PC A02/MF A01; 1 (GPO Dep.) | E 1.99: | DE85017557 | MN -34 | 10:46934 |
| 85-2887 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: | DE85017555 | MN -91 | 10:47234 |
| 85-2902 | NTIS, PC A03/MF A01 (GPO Dep.) | E 1.99: | DE85017554 | MN -25 | 10:46742 |
| 85-2913 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: | DE85017552 | MN -59B | 10:46369 |
| 85-2914 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: | DE85017551 | MN -59B | 10:46370 |
| 85-2920 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: | DE85017550 | MN -25 | 10:46743 |
| 85-2929 | NTIS, PC A02/MF A01; 1 (GPO Dep.) | E 1.99: | DE85017547 | MN -70B | 10:46186 |
| 85-2944 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: | DE85017546 | MN -48 | 10:47427 |
| 85-2964 | NTIS, PC A03/MF A01; 1 (GPO Dep.) | E 1.99: | DE85017543 | MN -45 | 10:47182 |
| 85-2994 | NTIS, PC A03/MF A01; 1 (GPO Dep.) | E 1.99: | DE85017539 | MN -34A | 10:47514 |
| 85-3005 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: | DE85017337 | MN -33 | 10:46434 |
| 85-3026 | NTIS, PC A03/MF A01; 1 (GPO Dep.) | E 1.99: | DE85017533 | MN -25 | 10:46744 |
| 85-3043 | NTIS, PC A02/MF A01 - GPO (GPO Dep.) | E 1.99: | TI85017532 | MN -16 | 10:46229 |
| 85-3064 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: | DE85017530 | MN -28 | 10:47873 |
| 85-3084 | NTIS, PC A02/MF A01; 1 (GPO Dep.) | E 1.99: | DE85017528 | MN -10 | 10:46187 |
| 85-3098 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: | DE85017526 | MN -34B | 10:47845 |
| 85-3102 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: | DE85017525 | MN -70 | 10:47281 |
| 85-3111 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: | DE85017524 | MN -10 | 10:46897 |
| 85-3112 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: | DE85017523 | MN -4 | 10:46898 |
| **LAL-** | | | | | |
| 84-45 | NTIS (US Sales Only), PC A10/MF A01 | | DE85752141 | MN -34C | 10:47611 |

| Report Number | Availability Source | File Number | | Distribution Category | Abstract Number |
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| LASL- | | | | | |
| 008 | NTIS, PC A02/MF A01; 1 (GPO Dep.) | E 1.99: | DE85017448 | MN -28 | 10:47040 |
| LBL- | | | | | |
| 17801 | NTIS, PC A02/MF A01; 1 (GPO Dep.) | E 1.99: | DE85017638 | MN -32 | 10:47988 |
| 18909 | NTIS, PC A02/MF A01; 1 (GPO Dep.) | E 1.99: | DE85016631 | MN -37 | 10:47124 |
| 18946 | NTIS, PC A02/MF A01; 1 (GPO Dep.) | E 1.99: | DE85017640 | MN -28 | 10:47041 |
| 18953 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: | DE85017641 | MN -48 | 10:47515 |
| 18962 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: | DE85017669 | MN -28 | 10:47042 |
| 18963 | NTIS, PC A02/MF A01; 1 (GPO Dep.) | E 1.99: | DE85017642 | MN -28 | 10:47516 |
| 18966 | NTIS, PC A02/MF A01; 1 (GPO Dep.) | E 1.99: | DE85017643 | MN -28 | 10:47004 |
| 19174 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: | DE85017654 | MN -95d | 10:46641 |
| 19236 | NTIS, PC A02/MF A01; 1 (GPO Dep.) | E 1.99: | DE85017644 | MN -25 | 10:46745 |
| 19271 | NTIS, PC A02/MF A01; 1 (GPO Dep.) | E 1.99: | DE85016551 | MN -59B | 10:46371 |
| 19490 | NTIS, PC A03/MF A01 (GPO Dep.) | E 1.99: | DE85014545 | MN -94cc | 10:46593 |
| 19528 | NTIS, PC A02/MF A01; 1 (GPO Dep.) | E 1.99: | DE85016562 | MN -28 | 10:47020 |
| 19601 | NTIS, PC A02/MF A01; 1 (GPO Dep.) | E 1.99: | DE85017645 | MN -28 | 10:47949 |
| 19644 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: | DE85014531 | MN -94a | 10:46587 |
| 19645 | NTIS, PC A02/MF A01; 1 (GPO Dep.) | E 1.99: | DE85014524 | MN -94a | 10:46588 |
| 19746 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: | DE85016645 | MN -34D | 10:47639 |
| 19778 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: | DE85017647 | MN -95 | 10:46662 |
| 19779 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: | DE85017648 | MN -95 | 10:46663 |
| 19797 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: | DE85016565 | MN -28 | 10:47021 |
| 19806 | NTIS, PC A02/MF A01; 1 (GPO Dep.) | E 1.99: | DE85016630 | MN -34C | 10:47759 |
| 19809 | NTIS, PC A02/MF A01; 1 (GPO Dep.) | E 1.99: | DE85016557 | MN -28 | 10:47022 |
| 19818 | NTIS, PC A02/MF A01; 1 (GPO Dep.) | E 1.99: | DE85017670 | MN -95d | 10:46664 |
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| 19884 | NTIS, PC A02/MF A01; 1 (GPO Dep.) | E 1.99: | DE85016633 | MN -34 | 10:47518 |
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| 20011 | NTIS, PC A09/MF A01; 1 (GPO Dep.) | E 1.99: | DE85017635 | MN -25 | 10:46747 |
| 20031 | NTIS, PC A08/MF A01; 1 (GPO Dep.) | E 1.99: | DE85017656 | MN -4 | 10:46899 |
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| 84-01 | NTIS (US Sales Only), PC A03/MF A01 | | DE85752146 | MN -34D | 10:47613 |
| LPNHE- | | | | | |
| 84-04 | NTIS (US Sales Only), PC A12/MF A01 | | DE85752145 | MN -34D | 10:47614 |
| LUNFD6/NFFR- | | | | | |
| 3048/ 1-27(1983) | NTIS (US Sales Only), PC A03/MF A01 | | DE85702237 | MN -32 | 10:47989 |
| 3049/ 1-27(1983) | NTIS (US Sales Only), PC A03/MF A01 | | DE85702238 | MN -32 | 10:47990 |
| 3050/ 1-198(1983) | NTIS (US Sales Only), PC A09/MF A01 | | DE85702106 | MN -34C | 10:47847 |
| 3052/ 1-250(1984) | NTIS (US Sales Only), PC A12/MF A01 | | DE85702100 | MN -34C | 10:47660 |
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| 7003/ 1-15 | NTIS (US Sales Only), PC A04/MF A01; 1 | | DE85752513 | MN -38 | 10:46826 |
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| 83-009 | NTIS, PC A15/MF A01; 1 (GPO Dep.) | E 1.99: | DE85017259 | MN -78 | 10:46539 |
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| 75 | NTIS (US Sales Only), PC A02/MF A01 | | DE85702135 | MN -34B | 10:47230 |
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| 85-68-0002 | NTIS, PC A03/MF A01 (GPO Dep.) | E 1.99: | DE85017384 | MN -13 | 10:47185 |
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| NASA-TM- | | | | | |
| 87034 | *See* DOE/NASA/12726-25 | E 1.99: | DE85013034 | STD -94c | 10:46592 |
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| 84-2959 | NTIS, PC A03/MF A01; 1 (GPO Dep.) | E 1.99: | DE85017205 | MN -25 | 10:46748 |
| 85-3026 | NTIS, PC A07/MF A01; 1 (GPO Dep.) | E 1.99: | DE85017253 | MN -95d | 10:46944 |
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| 5752541 | NTIS (US Sales Only), PC A04/MF A01; 1 | DE85752541 | MN -61D | 10:46261 |
| 5752626 | Danmarks Tekniske Hoejskole, Lyngby. Lab. for Varmeisolering | | ND -59A | 10:46276 |
| 5752627 | Danmarks Tekniske Hoejskole, Lyngby. Lab. for Varmeisolering | | ND -11 | 10:47235 |
| 5752630 | NTIS (US Sales Only), PC A04/MF A01; 1 | DE85752630 | MN -95d | 10:46667 |
| 5752635 | NTIS (US Sales Only), PC A03/MF A01 | DE85752635 | MN -38 | 10:46984 |
| 5752636 | NTIS (US Sales Only), PC A05/MF A01; 1 | DE85752636 | MN -61E | 10:46697 |
| 5752639 | Geoteknisk Inst., Lyngby (Denmark) | | ND -25 | 10:46698 |
| 5752641 | Danmarks Tekniske Hoejskole, Lyngby. Inst. for Skibs- og Havteknik | | ND -64 | 10:46386 |
| 5752642 | NTIS (US Sales Only), PC A02/MF A01; 1 | DE85752642 | MN -97e | 10:46267 |
| 5752643 | Burmeister og Wain Energi A/S, Copenhagen (Denmark) | | ND -89 | 10:46048 |
| 5752644 | Kongelige Veterinaer- og Landbohoejskole, Copenhagen (Denmark) | | ND -95f | 10:46699 |
| 5752651 | NTIS (US Sales Only), PC A03/MF A01 | DE85752651 | MN -95 | 10:46668 |
| 5752652 | Groenlands Geologiske Undersoegelse, Copenhagen (Denmark) | | ND -11 | 10:47446 |
| 5752654 | Harry og Mogens Larsen A/S, Odense (Denmark) | | ND -95d | 10:46706 |
| 5752655 | Harry og Mogens Larsen A/S, Odense (Denmark) | | ND -95d | 10:46707 |
| 5752656 | Harry og Mogens Larsen A/S, Odense (Denmark) | | ND -95d | 10:46708 |
| 5752660 | NTIS (US Sales Only), PC A03/MF A01 | DE85752660 | MN -97b | 10:46625 |
| 5752663 | NTIS (US Sales Only), PC A04/MF A01 | DE85752663 | MN -95d | 10:46669 |
| 5752664 | Copenhagen Univ. (Denmark). Oekonomisk Inst. | | ND -98 | 10:46621 |
| 5752666 | NTIS (US Sales Only), PC A08/MF A01; 1 | DE85752666 | MN -95d | 10:46670 |
| 5752667 | Danmarks Tekniske Hoejskole, Lyngby. Lab. for Varmeisolering | | ND -62 | 10:46376 |
| 5770358 | NTIS (US Sales Only), PC A03/MF A01 | DE85770358 | MN -60 | 10:46390 |
| 5770359 | NTIS (US Sales Only), PC A06/MF A01; 1 | DE85770359 | MN -95e | 10:46709 |
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| 5770361 | NTIS (US Sales Only), PC A08/MF A01; 1 | DE85770361 | MN -88 | 10:46039 |
| 5770362 | NTIS (US Sales Only), PC A06/MF A01; 1 | DE85770362 | MN -90d | 10:45955 |
| 5770363 | NTIS (US Sales Only), PC A07/MF A01; 1 | DE85770363 | MN -90e | 10:46049 |
| 5770364 | NTIS (US Sales Only), PC A02/MF A01 | DE85770364 | MN -13 | 10:46630 |
| 5770365 | NTIS (US Sales Only), PC A04/MF A01; 1 | DE85770365 | MN -13 | 10:46603 |
| 5770366 | NTIS (US Sales Only), PC A14/MF A01; 1 | DE85770366 | MN -92a | 10:47464 |
| 5770367 | NTIS (US Sales Only), PC A06/MF A01; 1 | DE85770367 | MN -90 | 10:46040 |
| 5770368 | NTIS (US Sales Only), PC A04/MF A01 | DE85770368 | MN -25 | 10:46750 |
| 5770369 | NTIS (US Sales Only), PC A06/MF A01; 1 | DE85770369 | MN -11 | 10:47202 |
| 5770370 | NTIS (US Sales Only), PC A10/MF A01; 1 | DE85770370 | MN -4 | 10:46866 |
| 5770371 | NTIS (US Sales Only), PC A08/MF A01; 1 | DE85770371 | MN -90c | 10:45956 |
| 5770372 | NTIS (US Sales Only), PC A11/MF A01; 1 | DE85770372 | MN -38 | 10:46945 |
| 5770373 | NTIS (US Sales Only), PC A06/MF A01 | DE85770373 | MN -90 | 10:46041 |
| 5770374 | NTIS (US Sales Only), PC A08/MF A01; 1 | DE85770374 | MN -63 | 10:46323 |
| 5901816 | Energy Administration, Michigan Dept. of Commerce, Box 30228, Lansing MI 48909 | TI85901816 | MN -95d | 10:46671 |
| 5901842 | NTIS, PC A04/MF A01 | DE85901842 | MN -94ce | 10:46594 |
| 5902041 | NTIS, PC A06; 3 | DE85902041 | MN -11 | 10:47210 |
| 5902094 | NTIS, PC A06/MF A01; 1 | DE85902094 | MN -63 | 10:46345 |
| 5902098 | NTIS, PC A02/MF A01 | DE85902098 | MN -92 | 10:46078 |
| 5902099 | NTIS, PC A02/MF A01 | DE85902099 | MN -92 | 10:46084 |
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| 0020-Vol.9-No.7 | NTIS, PC A19/MF A01 - GPO | TI85902114 | MN -80 | 10:46436 |
| 0090-Vol.8-No.1 | NTIS, PC A03/MF A01 - GPO | TI85901845 | MN -80 | 10:46540 |
| 0386-Digest-No.3-Suppl.1-5 | NTIS, PC A99/MF A01 - GPO | TI85902031 | MN -2 | 10:46440 |
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| 1030 | NTIS, PC A10/MF A01 - GPO | TI85902119 | MN -80 | 10:46541 |
| 1142 | NTIS, PC A23/MF A01 - GPO | TI85902214 | MN -78 | 10:46438 |
| 1154 | NTIS, PC A05/MF A01 - GPO | TI85902000 | MN -78 | 10:46542 |
| 1157 | NTIS, PC A18/MF A01 - GPO | TI85902163 | MN -11 | 10:46213 |
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| 1288 | NTIS, PC A03/MF A01 - GPO | TI85015937 | MN -78 | 10:46543 |
| 1480 | NTIS, PC A02/MF A01 - GPO | TI85015912 | MN -78 | 10:46544 |
| 1558 | Research Reports Center, Box 50490, Palo Alto, CA 94303 | TI85920182 | ND -78 | 10:46545 |
| 1837 | NTIS, PC A02/MF A01 - GPO | TI85015922 | MN -78 | 10:46546 |
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| 3413 | NTIS, PC A17/MF A01 - GPO | TI85017825 | MN -70 | 10:46189 |
| 3706 | NTIS, PC A12/MF A01 - GPO | TI85014233 | MN -78 | 10:46550 |
| 3949-Vol.2 | NTIS, PC A02/MF A01 - GPO | TI85014818 | MN -80 | 10:46416 |
| 3980-Vol.4 | NTIS, PC A04/MF A01 - GPO | TI85017823 | MN -78 | 10:46551 |
| 4076 | NTIS, PC A03/MF A01 - GPO | TI85014154 | MN -70 | 10:46214 |
| 4081 | NTIS, PC A10/MF A01 - GPO | TI85014908 | MN -78 | 10:46552 |
| 4116 | NTIS, PC A19/MF A01 - GPO | TI85902159 | MN -78 | 10:46408 |
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| 4314 | NTIS, PC A03/MF A01 - GPO | | TI85016129 | MN -80 | 10:46555 |
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| 84-19 | NYSERDA, Two Rockefeller Plaza, Albany, NY 12223 | | TI85901971 | MN -90i | 10:46023 |
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| 3219 | NTIS (US Sales Only), PC A02/MF A01; 1 | | DE85902058 | MN -97 | 10:46400 |
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| 6147 | NTIS, PC A07/MF A01; 1 (GPO Dep.) | E 1.99: | DE85018115 | STD -41 | 10:46556 |
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| 189 | NTIS, PC A04/MF A01 (GPO Dep.) | E 1.99: | DE85018141 | MN -95d | 10:46672 |
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| 5223 | NTIS, PC A02/MF A01; 1 (GPO Dep.) | E 1.99: | DE85017021 | MN -96 | 10:46711 |
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| 81012 | NTIS (US Sales Only), PC A02/MF A01 | | DE85702123 | MN -51 | 10:47253 |
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| 4,510,455 | | | | | 10:46938 |
| 4,510,605 | | | | | 10:46936 |
| A 6-542,967 | | E 1.99: | DE85017764 | MN -48 | 10:47327 |
| A 6-668,054 | | E 1.99: | DE85017766 | MN -25 | 10:46785 |
| A 6-672,228 | | E 1.99: | DE85017768 | MN -38 | 10:46633 |
| A 6-672,229 | | E 1.99: | DE85017769 | MN -38 | 10:46932 |
| A 6-672,230 | | E 1.99: | DE85017770 | MN -11 | 10:47244 |
| A 6-673,968 | | E 1.99: | DE85017772 | MN -25 | 10:46796 |
| A 6-673,970 | | E 1.99: | DE85017774 | MN -25 | 10:46770 |
| A 6-676,045 | | E 1.99: | DE85017722 | MN -25 | 10:46786 |
| A 6-676,046 | | E 1.99: | DE85017723 | MN -63 | 10:46343 |
| A 6-676,047 | | E 1.99: | DE85017724 | MN -63 | 10:46342 |
| A 6-676,149 | | E 1.99: | DE85017725 | MN -45 | 10:47191 |
| A 6-676,338 | | E 1.99: | DE85017726 | MN -38 | 10:46940 |
| A 6-676,340 | | E 1.99: | DE85017727 | MN -93A | 10:46884 |
| A 6-676,343 | | E 1.99: | DE85017729 | MN -25 | 10:46822 |
| A 6-677,955 | | E 1.99: | DE85017731 | MN -25 | 10:46769 |
| A 6-678,202 | | E 1.99: | DE85017733 | MN -63 | 10:46341 |
| A 6-678,913 | | E 1.99: | DE85017734 | MN -15 | 10:46162 |
| A 6-679,842 | | E 1.99: | DE85017736 | MN -63 | 10:46340 |
| A 6-684,099 | | E 1.99: | DE85017738 | MN -61 | 10:46339 |
| A 6-685,013 | | E 1.99: | DE85017739 | MN -83 | 10:46161 |
| A 6-688,668 | | E 1.99: | DE85017743 | MN -62 | 10:46591 |
| A 6-688,669 | | E 1.99: | DE85017744 | MN -86 | 10:46167 |
| A 6-688,670 | | E 1.99: | DE85017745 | MN -90i | 10:46910 |
| A 6-688,671 | | E 1.99: | DE85017746 | MN -25 | 10:46716 |
| A 6-688,672 | | E 1.99: | DE85017747 | MN -45 | 10:47190 |
| A 6-688,673 | | E 1.99: | DE85017748 | MN -71 | 10:46205 |
| A 6-690,022 | | E 1.99: | DE85017751 | MN -11 | 10:47212 |
| A 6-690,023 | | E 1.99: | DE85017752 | MN -11 | 10:47213 |
| A 6-690,218 | | E 1.99: | DE85017753 | MN -63 | 10:46338 |
| A 6-691,825 | | E 1.99: | DE85017755 | MN -34A | 10:47177 |
| A 6-692,760 | | E 1.99: | DE85017783 | MN -38 | 10:46931 |
| A 6-696,276 | | E 1.99: | DE85017785 | MN -45 | 10:47189 |
| A 6-696,547 | | E 1.99: | DE85017786 | MN -25 | 10:46904 |
| A 6-697,828 | | E 1.99: | DE85017793 | MN -25 | 10:46970 |
| A 6-697,989 | | E 1.99: | DE85017794 | MN -4 | 10:46856 |
| A 6-699,092 | | E 1.99: | DE85017795 | MN -25 | 10:47955 |
| A 6-699,888 | | E 1.99: | DE85017788 | MN -48 | 10:47325 |
| A 6-699,889 | | E 1.99: | DE85017799 | MN -90i | 10:47211 |
| A 6-700,845 | | E 1.99: | DE85017800 | MN -25 | 10:46768 |
| A 6-702,569 | | E 1.99: | DE85017803 | MN -48 | 10:46939 |
| A 6-702,716 | | E 1.99: | DE85017806 | MN -45 | 10:47188 |
| A 6-704,114 | | E 1.99: | DE85017760 | MN -90c | 10:46980 |
| A 6-704,115 | | E 1.99: | DE85017761 | MN -38 | 10:46930 |
| A 6-704,697 | | E 1.99: | DE85017763 | MN -25 | 10:46821 |
| **PB-** | | | | | |
| 85-186476/ XAB | NTIS PC E03/MF E03 | | | | 10:47615 |
| 85-189538/ XAB | NTIS PC E04/MF E04 | | | | 10:46700 |
| 85-189983/ XAB | NTIS PC E03/MF E03 | | | | 10:47475 |
| 85-190635/ XAB | NTIS PC E03/MF E03 | | | | 10:47616 |
| 85-193811/ XAB | NTIS PC E07/MF E07 | | | | 10:46701 |
| 85-195063/ XAB | NTIS PC E03/MF A01 | | | | 10:46064 |
| 85-199693/ XAB | NTIS, PC A24/MF A01 | | | | 10:46066 |
| 85-200871/ XAB | NTIS, PC A13/MF A01 | | | | 10:47434 |
| 85-201333/ XAB | NTIS PC E07/MF E07 | | | | 10:46324 |
| 85-202224/ XAB | NTIS PC E03/MF E01 | | | | 10:46381 |
| 85-204295/ XAB | NTIS, PC A15/MF A01 | | | | 10:46351 |
| 85-219632/ XAB | NTIS, PC A03/MF A01 | | | | 10:46908 |
| **PITHA-** | | | | | |
| 82/ 24 | NTIS (US Sales Only), PC A02/MF A01 | | DE85752315 | MN -34D | 10:47562 |
| 83/ 24 | NTIS (US Sales Only), PC A02/MF A01 | | DE85752317 | MN -34C | 10:47667 |
| 84/ 21 | NTIS (US Sales Only), PC A03/MF A01 | | DE85752319 | MN -34D | 10:47563 |
| 84/ 32 | NTIS (US Sales Only), PC A02/MF A01 | | DE85752318 | MN -34D | 10:47564 |
| **PNL-** | | | | | |
| 4465-Rev.1 | NTIS, PC A21/MF A01 (GPO Dep.) | E 1.99: | DE85017885 | MN -70 | 10:46192 |
| 4790 | *See* NUREG/CR-3413 | | TI85017825 | MN -70 | 10:46189 |
| 4980-Vol.2 | NTIS, PC A10/MF A01; 1 (GPO Dep.) | E 1.99: | DE85018049 | MN -70B | 10:46193 |
| 5130 | NTIS, PC A08/MF A01; 1 (GPO Dep.) | E 1.99: | DE85017692 | MN -70 | 10:46194 |
| 5324 | *See* NUREG/CR-4076 | | TI85014154 | MN -70 | 10:46214 |
| 5386 | *See* NUREG/CR-4176 | | TI85013751 | MN -70 | 10:46215 |
| 5448 | NTIS, PC A09/MF A01 (GPO Dep.) | E 1.99: | DE85015241 | MN -94c | 10:46595 |
| 5461-Vol.1 | *See* NUREG/CR-4251-Vol.1 | | TI85017658 | MN -11 | 10:47294 |
| 5461-Vol.2 | *See* NUREG/CR-4251-Vol.2 | | TI85017659 | MN -11 | 10:47295 |
| 5507 | NTIS, PC A03/MF A01 (GPO Dep.) | E 1.99: | DE85014851 | MN -94e | 10:46589 |
| 5533 | NTIS, PC A04/MF A01 (GPO Dep.) | E 1.99: | DE85017871 | MN -70B | 10:46195 |
| 5541 | NTIS, PC A05/MF A01 (GPO Dep.) | E 1.99: | DE85017889 | MN -41 | 10:46221 |
| **PNL-SA-** | | | | | |
| 7655 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: | DE85017662 | MN -11 | 10:47254 |

| Report Number | Availability Source | File Number | | Distribution Category | Abstract Number |
|---|---|---|---|---|---|
| 9017 | NTIS, PC A02/MF A01 | | TI85016697 | MN -78 | 10:46468 |
| 9021 | NTIS, PC A03/MF A01 - GPO | | TI85016698 | MN -78 | 10:46469 |
| 9022 | NTIS, PC A02/MF A01 - GPO | | TI85016699 | MN -78 | 10:46418 |
| 9322 | NTIS, PC A02/MF A01 - GPO | | TI85016690 | MN -78 | 10:46557 |
| 10459 | NTIS | | | | 10:46965 |
| 11518 | NTIS, PC A03/MF A01; 1 (GPO Dep.) | E 1.99: | DE85017922 | MN -91 | 10:46100 |
| 12823 | NTIS | | | | 10:46675 |
| 12895 | NTIS, PC A02/MF A01; 1 (GPO Dep.) | E 1.99: | DE85016615 | MN -11 | 10:47261 |
| 12972 | NTIS, PC A02/MF A01; 1 (GPO Dep.) | E 1.99: | DE85016277 | MN -86 | 10:46160 |
| 12996 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: | DE85017911 | MN -25 | 10:46752 |
| 13104 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: | DE85017863 | MN -61D | 10:46253 |
| 13161 | NTIS, PC A02/MF A01 - GPO | | TI85016912 | MN -78 | 10:46558 |
| 13190 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: | DE85017899 | MN -95d | 10:46456 |
| 13277 | NTIS, PC A03/MF A01; 1 (GPO Dep.) | E 1.99: | DE85016617 | MN -32 | 10:47991 |
| 13282 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: | DE85016621 | MN -11 | 10:47282 |
| 13305 | NTIS, PC A02/MF A01; 1 (GPO Dep.) | E 1.99: | DE85017919 | MN -70 | 10:46196 |
| 13315 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: | DE85017914 | MN -70B | 10:46216 |
| **PPPL-** | | | | | |
| 2241 | NTIS, PC A03/MF A01 (GPO Dep.) | E 1.99: | DE85017458 | STD -20f | 10:47910 |
| **PPPL-TRANS-** | | | | | |
| 129 | NTIS, PC A03/MF A01; 1 (GPO Dep.) | E 1.99: | DE85017017 | MN -20 | 10:47931 |
| **PSI-** | | | | | |
| 530/ SR-217 | *See* CONF-850836-5 | E 1.99: | DE85014622 | MN -93A | 10:46635 |
| **PTB-Dos-** | | | | | |
| 10 | NTIS (US Sales Only) | | DE85752248 | MN -48 | 10:47870 |
| 11 | NTIS (US Sales Only) | | DE85752249 | MN -41 | 10:47128 |
| **PTB-Me-** | | | | | |
| 66 | Physikalisch-Technische Bundesanstalt, Braunschweig, Germany, F.R. | | | ND -79f | 10:46478 |
| **PTB-Ra-** | | | | | |
| 17 | NTIS (US Sales Only) | | DE85752253 | MN -92a | 10:46054 |
| **PWA-** | | | | | |
| 83/ 84 | *See* KFK-3835 | | DE85752245 | MN -86 | 10:46238 |
| **PWR/FBWG/P-** | | | | | |
| 83-142 | *See* ND-R-930(S) | | DE85702116 | MN -25 | 10:46749 |
| **RAND-P-** | | | | | |
| 7009-RGI | *See* AD-A-154861/9/XAB | | | | 10:47194 |
| **REG/G-** | | | | | |
| 1-28-Rev.3 | GPO | | TI85901998 | MN -2 | 10:46439 |
| **REPT-** | | | | | |
| 85-01 | *See* PB-85-202224/XAB | | | | 10:46381 |
| **RERF-TR-** | | | | | |
| 11-83 | NTIS (US Sales Only), PC A08/MF A01 | | DE85702141 | MN -48 | 10:47393 |
| 13-82 | NTIS (US Sales Only), PC A02/MF A01 | | DE85702142 | MN -48 | 10:47394 |
| **RFP-** | | | | | |
| 3792 | NTIS, PC A02/MF A01; 1 (GPO Dep.) | E 1.99: | DE85013212 | MN -15 | 10:46231 |
| 3802 | NTIS, PC A02/MF A01; 1 (GPO Dep.) | E 1.99: | DE85013229 | MN -10 | 10:46851 |
| 3821 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: | DE85016113 | MN -15 | 10:46222 |
| 3824 | NTIS, PC A02/MF A01; 1 (GPO Dep.) | E 1.99: | DE85013215 | MN -4 | 10:46166 |
| **RHO-BW-SR-** | | | | | |
| 85-1-1QP | NTIS, PC A03/MF A01 (GPO Dep.) | E 1.99: | DE85016788 | MN -70 | 10:46197 |
| **RHO-ML-SA-** | | | | | |
| 3 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: | DE85015393 | MN -11 | 10:47241 |
| **RHO-SS-SA-** | | | | | |
| 18P | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: | DE85017242 | MN -15 | 10:46852 |
| **RHO-WM-EV-** | | | | | |
| 8P | NTIS, PC A03/MF A01 (GPO Dep.) | E 1.99: | DE85016289 | MN -70 | 10:46198 |
| **RHO-WM-SR-** | | | | | |
| 3P | NTIS, PC A05/MF A01 (GPO Dep.) | E 1.99: | DE85017301 | MN -70 | 10:46199 |
| **RISO-M-** | | | | | |
| 2458 | NTIS (US Sales Only), PC A07/MF A01 | | DE85752648 | MN -48 | 10:47333 |
| 2473 | NTIS (US Sales Only), PC A02/MF A01 | | DE85702149 | MN -41 | 10:46900 |
| 2475 | NTIS (US Sales Only), PC A02/MF A01 | | DE85702136 | MN -34B | 10:47231 |
| 2477 | NTIS (US Sales Only), PC A04/MF A01 | | DE85752649 | MN -48 | 10:47334 |
| 2482 | NTIS (US Sales Only), PC A02/MF A01 | | DE85702072 | MN -20 | 10:47950 |
| 2488 | NTIS (US Sales Only), PC A03/MF A01 | | DE85752659 | MN -25 | 10:46782 |
| 2489 | NTIS (US Sales Only), PC A13/MF A01; 1 | | DE85752647 | MN -94c | 10:46596 |
| 2490 | NTIS (US Sales Only), PC A05/MF A01 | | DE85752646 | MN -92 | 10:46068 |
| 2503 | NTIS (US Sales Only), PC A05/MF A01 | | DE85752650 | MN -92a | 10:46055 |
| 2515 | NTIS (US Sales Only), PC A02/MF A01 | | DE85752662 | MN -92a | 10:46056 |
| **RISO-R-** | | | | | |
| 487 | NTIS (US Sales Only), PC A07/MF A01 | | DE85702122 | MN -51 | 10:47255 |
| 506 | NTIS (US Sales Only), PC A09/MF A01 | | DE85702121 | MN -25 | 10:46753 |
| 507 | NTIS (US Sales Only), PC A22/MF A01 | | DE85702210 | MN -37 | 10:47129 |
| 513 | NTIS (US Sales Only), PC A03/MF A01 | | DE85702240 | MN -2 | 10:47967 |
| 517 | NTIS (US Sales Only), PC A05/MF A01 | | DE85781588 | MN -34 | 10:47874 |
| **RKS-** | | | | | |
| 83-07 | NTIS (US Sales Only), PC A03/MF A01 | | DE85702166 | MN -25 | 10:46966 |
| 83-11 | NTIS (US Sales Only), PC A02/MF A01 | | DE85702184 | MN -80 | 10:46479 |
| 84-02 | NTIS (US Sales Only), PC A03/MF A01 | | DE85702185 | MN -80 | 10:46480 |
| **SAND-** | | | | | |
| 81-0326C | NTIS, PC A03/MF A01 - GPO | | TI85016710 | MN -78 | 10:46559 |
| 83-1847 | NTIS, PC A05/MF A01; 1 (GPO Dep.) | E 1.99: | DE85014161 | MN -70 | 10:46200 |
| 83-2270 | NTIS, PC A04/MF A01; 1 (GPO Dep.) | E 1.99: | DE85017250 | STD -94a | 10:46597 |

| Report Number | Availability Source | File Number | | Distribution Category | Abstract Number |
|---|---|---|---|---|---|
| 84-0763 | NTIS PC E05/MF A01; 1 (GPO Dep.) | E 1.99: | DE85017353 | MN -79a | 10:46560 |
| 84-1739C | NTIS, PC A02/MF A01; 1 (GPO Dep.) | E 1.99: | DE85007107 | MN -25 | 10:46967 |
| 84-2244C | NTIS, PC A02/MF A01; 1 (GPO Dep.) | E 1.99: | DE85008410 | MN -25 | 10:47459 |
| 84-2645 | NTIS, PC A06/MF A01; 1 (GPO Dep.) | E 1.99: | DE85016197 | STD -71 | 10:46168 |
| 85-0160 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: | DE85016916 | MN -15 | 10:46232 |
| 85-0322C | NTIS, PC A03/MF A01; 1 (GPO Dep.) | E 1.99: | DE85017381 | MN -25 | 10:46754 |
| 85-0354C | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: | DE85016580 | MN -38 | 10:47161 |
| 85-0479 | NTIS, PC A03/MF A01 (GPO Dep.) | E 1.99: | DE85014344 | STD -71 | 10:46946 |
| 85-0485C | NTIS, PC A02/MF A01; 1 (GPO Dep.) | E 1.99: | DE85016815 | MN -25 | 10:46755 |
| 85-0546C | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: | DE85008210 | MN -37 | 10:47133 |
| 85-0691C | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: | DE85017117 | MN -37 | 10:47134 |
| 85-0723C | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: | DE85014640 | MN -38 | 10:47135 |
| 85-0757 | NTIS, PC A03/MF A01 (GPO Dep.) | E 1.99: | DE85017391 | MN -62b | 10:46756 |
| 85-0788C | NTIS (US Sales Only), PC A02/MF A01 (GPO Dep.) | E 1.99: | DE85017371 | MN -35 | 10:47186 |
| 85-0867 | NTIS, PC A02/MF A01; 1 (GPO Dep.) | E 1.99: | DE85017320 | MN -38 | 10:46923 |
| 85-0924C | NTIS, PC A02/MF A01; 1 (GPO Dep.) | E 1.99: | DE85017000 | MN -90c | 10:45957 |
| 85-1131C | NTIS MF A01; 2 (GPO Dep.) | E 1.99: | DE85016581 | MN -15 | 10:46233 |
| 85-1359C | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: | DE85017370 | MN -70 | 10:46924 |
| 85-1421C | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: | DE85016193 | MN -63b | 10:46346 |
| 85-1509C | NTIS, PC A03/MF A01 (GPO Dep.) | E 1.99: | DE85016458 | MN -25 | 10:46757 |
| 85-1522C | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: | DE85015815 | MN -34B | 10:47476 |
| 85-1532 | NTIS, PC A10/MF A01 (GPO Dep.) | E 1.99: | DE85017883 | MN -92 | 10:46067 |
| 85-1647C | NTIS, PC A02; 3 | | DE85016802 | MN -25 | 10:46783 |
| 85-1677C | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: | DE85017232 | MN -16 | 10:46234 |
| 85-1687C | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: | DE85017428 | MN -25 | 10:46758 |
| 85-1700 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: | DE85015490 | MN -41 | 10:47437 |
| 85-1736C | NTIS, PC A02/MF A01 - GPO | | TI85016164 | MN -70 | 10:46201 |
| 85-1764C | NTIS, PC A02/MF A01; 1 (GPO Dep.) | E 1.99: | DE85016542 | MN -63 | 10:46347 |
| 85-1775C | NTIS, PC A02/MF A01; 1 (GPO Dep.) | E 1.99: | DE85017120 | MN -21 | 10:47951 |
| 85-1807C | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: | DE85017116 | MN -37 | 10:47162 |
| 85-1866C | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: | DE85017231 | MN -66c | 10:46385 |
| 85-1874C | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: | DE85017110 | MN -15 | 10:46235 |
| 85-1914C | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: | DE85017372 | MN -66a | 10:46382 |
| 85-7180 | NTIS, PC A05/MF A01; 1 (GPO Dep.) | E 1.99: | DE85017775 | STD -71 | 10:46236 |
| 85-7187 | NTIS, PC A04/MF A01; 1 (GPO Dep.) | E 1.99: | DE85015369 | STD -70 | 10:46223 |
| 85-7197C | NTIS, PC A02; 3 | | DE85011711 | MN -94cb | 10:46598 |
| 85-7200C | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: | DE85012839 | MN -90d | 10:45958 |
| 85-7211 | NTIS, PC A10/MF A01; 1 (GPO Dep.) | E 1.99: | DE85017874 | MN -90d | 10:45959 |
| 85-7216C | NTIS, PC A02/MF A01; 1 (GPO Dep.) | E 1.99: | DE85016996 | MN -94cb | 10:46599 |
| 85-8215 | NTIS, PC A04/MF A01 (GPO Dep.) | E 1.99: | DE85017424 | MN -32 | 10:47531 |
| 85-8227 | NTIS, PC A02/MF A01 (GPO Dep.) | E 1.99: | DE85017341 | MN -15 | 10:46237 |
| **SBI-MEDD-** | | | | | |
| 48 | NTIS (US Sales Only), PC A08/MF A01; 1 | | DE85752645 | MN -95f | 10:46676 |
| **SBI-R-** | | | | | |
| 164 | NTIS (US Sales Only), PC A04/MF A01 | | DE85752628 | MN -95d | 10:46685 |
| **SCPRI-RM-** | | | | | |
| 11-1984 | NTIS (US Sales Only), PC A03/MF A01 | | DE85752164 | MN -11 | 10:47232 |
| **SERI/STR-** | | | | | |
| 211-2695 | NTIS, PC A03/MF A01; 1 (GPO Dep.) | E 1.99: | DE85016848 | STD -63b | 10:46325 |
| 211-2731 | NTIS, PC A03/MF A01 (GPO Dep.) | E 1.99: | DE85012173 | STD -63b | 10:46326 |
| 211-2735 | NTIS, PC A04/MF A01 (GPO Dep.) | E 1.99: | DE85016852 | STD -63 | 10:46327 |
| 211-2746 | NTIS, PC A03/MF A01; 1 (GPO Dep.) | E 1.99: | DE85016853 | STD -63 | 10:46328 |
| 211-2750 | NTIS, PC A04/MF A01; 1 (GPO Dep.) | E 1.99: | DE85016851 | STD -63 | 10:46329 |
| 211-2760 | NTIS, PC A03/MF A01 (GPO Dep.) | E 1.99: | DE85016847 | STD -63 | 10:46330 |
| 211-2777 | NTIS, PC A03/MF A01; 1 (GPO Dep.) | E 1.99: | DE85016849 | STD -63 | 10:46331 |
| **SERI/TP-** | | | | | |
| 253-2744 | NTIS, PC A02/MF A01; 1 (GPO Dep.) | E 1.99: | DE85012163 | MN -59B | 10:46377 |
| 255-2771 | NTIS, PC A02/MF A01; 1 (GPO Dep.) | E 1.99: | DE85012170 | MN -62 | 10:47163 |
| 255-2791 | NTIS, PC A02/MF A01; 1 (GPO Dep.) | E 1.99: | DE85012171 | MN -62 | 10:46350 |
| **SERI/TR-** | | | | | |
| 255-2590 | NTIS, PC A04/MF A01; 1 (GPO Dep.) | E 1.99: | DE85012160 | MN -62 | 10:46378 |
| **SIKOB-** | | | | | |
| 1828 | *See* STU-80-3085 | | DE85752515 | MN -95f | 10:46686 |
| **SKBF-KBS-TR-** | | | | | |
| 83-73 | NTIS (US Sales Only), PC A04/MF A01 | | DE85701865 | MN -51 | 10:47256 |
| **SKI-** | | | | | |
| 84-3 | NTIS (US Sales Only), PC A15/MF A01 | | DE85702225 | MN -70 | 10:46217 |
| **SKI-B-** | | | | | |
| 26-81 | NTIS (US Sales Only), PC A03/MF A01 | | DE85702180 | MN -80 | 10:46470 |
| 36-81 | NTIS (US Sales Only), PC A13/MF A01 | | DE85702186 | MN -80 | 10:46481 |
| 42-83 | NTIS (US Sales Only), PC A03/MF A01 | | DE85702117 | MN -25 | 10:46759 |
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TH Thailand
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TR Turkey
TT Trinidad and Tobago
TW Taiwan
TZ United Republic of Tanzania

UA Ukrainian Soviet Socialist Republic (Ukrainian SSR)
UG Uganda
US United States of America (USA)
UY Uruguay

VA Holy See
VD Democratic Republic of Vietnam
VE Venezuela
VS Republic of Vietnam

WS Western Samoa

YD Democratic Yemen
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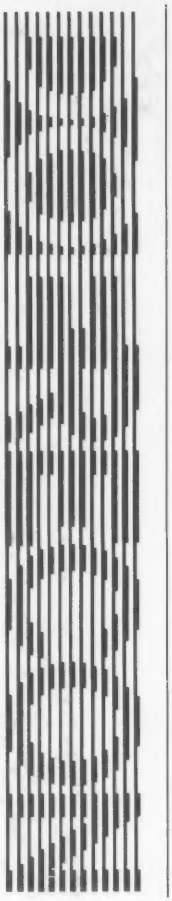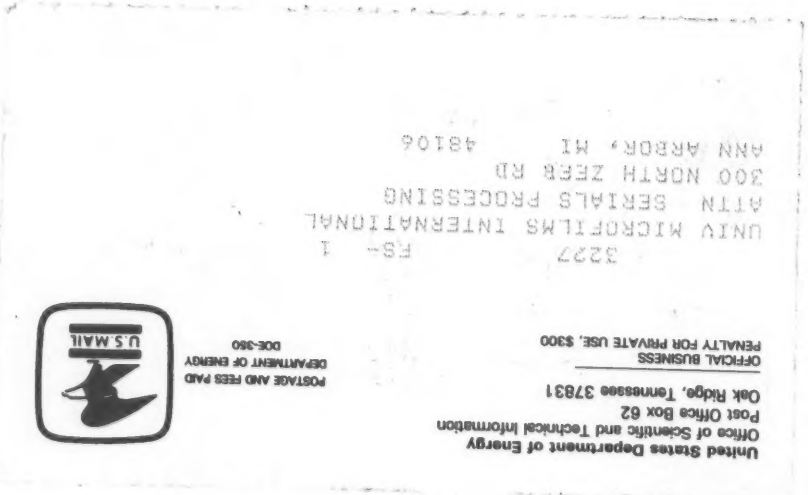
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